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SECOND SERIES, NO. 76.

BULLETIN

—OF THE—

AGRICULTURAL EXPERIMENT STATION

—OF THE—

Louisiana State University and A. & M. College.

W. C. STUBBS, Ph, D., Director and State Chemist.

Analyses of Commercial Fertilizers and Paris Green.

ISSUED BY THE LOUISIANA STATE BOARD OF AGRICULTURE AND IMMIGRATION,
J. G LEE, COMMISSIONER.

BATON ROUGE, LA.
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308176

LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE,
OFFICE OF STATE EXPERIMENT STATION,
Baton Rouge, La., September 1, 1903.

Major J. G. Lee, Commissioner of Agriculture and Immigration, Baton Rouge, La.

DEAR SIR:—I hand you herewith analyses of Commercial Fertilizers and Paris Greens, made in the laboratories of the Station since last season.

Respectfully submitted,
WILLIAM C. STUBBS,
Director and State Chemist.

REPORT OF THE DIRECTOR AND STATE CHEMIST.

The analysis of commercial fertilizers contained in this report are of four kinds:

1. Samples selected at the discretion of the Commissioner of Agriculture and inspectors for purpose of inspection.
2. Samples drawn by the purchaser, under regulations prescribed by the Commissioner of Agriculture.

The above are required by law.

3. Samples used by the Stations.
4. Samples sent by private parties.

While the Station is not required by law to work for private parties, yet all samples sent by individual citizens of the State will be analyzed without charge; *provided,* the means of the Station will permit; *provided,* always, that in the discretion of the Director such analysis will be conducive to public welfare.

Under the fertilizer law, every citizen of the State is amply protected from fraud and imposition by unscrupulous dealers, and there exists absolutely no cause for distrust in the purchase of commercial fertilizers, if the farmer will but claim the protection afforded him. The sellers of good wares are also protected, as ample facilities are afforded them of properly advertising their goods.

AMENDMENT TO PRESENT FERTILIZER LAW.

During the last session of the Legislature the following act was passed amending the present fertilizer law. The object of this amendment is to include among materials subject to the provisions of the fertilizer law all cotton seed meal sold for fertilizing purposes. With this Act in effect only the following materials are now exempt from the law: *Lime, Ashes, Land Plaster and Salt.*

AN ACT

To amend and re-enact Sections 1 and 2 of Act No. 126, of 1898, entitled "An Act to carry into effect Article 306 of the Constitution of the State of Louisiana; to define the duties and powers of the State Board of Agriculture and Immigration, and those of the Commissioner of Agriculture and Immigration in relation to the suppression of adulteration and fraud in the sale of commercial fertilizers in conformity therewith; to provide for the inspection and analysis of all commercial fertilizers sold for use in the State of Louisiana, and for the payment by the seller of the inspection fees therefor; to authorize the appointment of fertilizer inspectors, to provide for guarantees of the component chemicals contained in fertilizers, and the affixing of tags to the packages thereof as evidence of the guarantee and inspection thereof; to prohibit the sale of illegal or fraudulent fertilizers in violation of the provisions of this Act, and affixing fines and penalties for the violation of the provisions of this Act; to provide for judicial proceedings *in rem* against fertilizers sold in contravention of this Act; to give the Commissioner of Agriculture and Immigration a privilege thereon, and the right to the writ of provisional seizure to conserve said privilege, and to define the methods of said procedure; to provide for suits for the recovery of fines and penalties and injunction under this Act, to provide for the distribution and expenditure of the fees and penalties collected under the provisions of this Act, and their appropriation to fertilizer experiment purposes, and to repeal Act No. 72, of 1894, in so far as it might operate in the future."

Approved July 13, 1898.

SECTION 1. *Be it enacted by the General Assembly of the State of Louisiana,* That section 1 of said Act, No. 126 of the regular session of the General Assembly of 1898, approved July 13, 1898, be amended and re-enacted so as to read as follows:

SECTION 1. That the State Board of Agriculture and Immigration shall have power to make and establish rules to carry out the designs and purposes of this Act, and in conformity thereto, for the purpose of maintaining effective control of the manufacture and sale in this State of all commercial fertilizers and cotton seed meal when sold or offered for sale as a fertilizer, and for the suppression of adulteration and fraud therein, as authorized by Article 306 of the Constitution of the State of Louisiana.

SECTION 2. *Be it further enacted, etc.*, That Section 2 of said Act No. 126, of 1898, be amended and re-enacted so as to read as follows:

SECTION 2. That it shall be the duty of any manufacturer or dealer in fertilizers, or any person soliciting orders, whether by sample or otherwise, or whether such orders are to be accepted by him or his principal, for the sale of any commercial fertilizer (which term is intended to and shall include cotton seed meal when sold or offered for sale as a fertilizer, but shall not include lime, and plaster, ashes or common salt), before the same is offered for sale in this State, to submit to the Commissioner of Agriculture and Immigration for inspection and analysis fair samples of the same, which shall be analyzed by the official chemist, and to furnish a written or printed statement setting forth: first, the name and brand under which said fertilizer is to be sold, the number of pounds contained or to be contained in the package in which it is to be put upon the market for sale, and the name of the manufacturer and the place or places of manufacture. Second, a statement setting forth the amount of the named ingredients, which he or they guarantee said fertilizer to contain—(1) nitrogen, (2) soluble phosphoric acid, (3) reverted phosphoric acid, (4) insoluble phosphoric acid, (5) potash. Said statement to be furnished accompanied by a sample or samples of the fertilizer to be inspected, and which shall be analyzed by the official chemist, shall be considered as constituting a guarantee to the purchaser that every package of such fertilizer contains not less than the amount of each ingredient set forth in the statement and contained in the sample or samples. This shall, however, preclude the party making the statement from setting forth any other ingredients which his fertilizer may contain, which additional ingredients shall be considered as embraced in the guarantee above stated. That an inspection fee of twenty-five cents per ton upon any fertilizer sold for use in this State, shall be paid by the seller, solicitor or agents, etc., thereof, to the Commissioner of Agriculture and Immigration, which inspection fee shall cover the cost of inspection and analysis made by the Commissioner or the official chemist, or at the request of either the seller or the buyer, and the certificate to be furnished by the Commissioner. Payment of said inspection fee shall be evidenced by tags to be furnished by the Commissioner of Agriculture and Immigration sufficient in number to place one upon each package of fertilizer required to make up a ton according to the way in which the particular fertilizer may be packed and shipped.

CAUTIONS IN BUYING FERTILIZERS.

Before purchasing, a farmer or planter should know the requirements of his crop and soil, and then buy only such manures as will supply them. Then get the dealer or manufacturer to answer the following questions:

How much soluble phosphoric acid do you guarantee?
How much reverted phosphoric acid do you guarantee?
How much nitrogen or ammonia do you guarantee?
How much potash do you guarantee?

With the reply to these questions one can easily calculate the approximate commercial value of a ton of the goods desired.

In a plain acid phosphate at least 12 per cent. available phosphoric acid should be guaranteed.

In cane fertilizers, 3 per cent. nitrogen and 7 per cent. available phosphoric acid, and in cotton fertilizers 2 per cent. nitrogen and 8 per cent. available phosphoric acid should be the least quantities accepted.

VALUATION OF FERTILIZERS.

The commercial value of a fertilizer is regulated by the prices demanded in commerce for the different forms of the three ingredients, nitrogen (ammonia), phosphoric acid and potash. These prices fluctuate according to the demand and supply. In some parts of the North, nitrogen is assigned a separate valuation for each of its forms—that in nitrates and ammonia salts receiving the highest figure, and in leather and peat, the lowest.

In Connecticut and Massachusetts, a determination of the forms in which this ingredient occurs must be made before its commercial value can be calculated. All the forms of nitrogen have heretofore been considered of equal money value in the South and but one price assigned. This, of course, precludes the existence of nitrogen in form of leather dust, or powdered horn, forms regarded as unavailable and of little money or agricultural value.

The soluble and reverted forms of phosphoric acid have together been styled as "available," and assigned one value. The insoluble phosphoric acid has received no valuation. All forms of potash soluble in water have been regarded as of equal value.

The following tariff of prices has been adopted for the past and coming season:

Nitrogen, 15 cents per pound, which makes ammonia 12 1-3 cents per pound.

Soluble phosphoric acid, 5 cents per pound.

Reverted phosphoric acid, 5 cents per pound.

Potash, 5 cents per pound.

The above prices may be used to illustrate the method by which the commercial value of a fertilizer may be approximately estimated, *e. g.:* A fertilizer containing by analysis the following:

Nitrogen, 3 per cent.; soluble phosphoric acid, 6 per cent.; reverted, 4 per cent.; potash, 2 per cent. What is the approximate commercial value per ton?

A ton will contain:

60	pounds nitrogen, 15 cents	$9.00
120	" soluble phosphoric acid, 5 cents	6.00
80	" reverted phosphoric acid, 5 cents	4.00
40	" potash, 5 cents	2.00
	Value per ton	$21.00

In this way the approximate value of any commercial fertilizer can be estimated. These prices are by no means fixed. They fluctuate almost daily in the markets of the world in accordance with the law of supply and demand. But the tariff given is believed to be nearly representative of the average of prices during the past year, and hence are adopted for the ensuing season.

LABORATORY WORK.

The following number of analyses have been made during the season just ended in the laboratories of the Stations:

Complete Fertilizers	2,286
Tankages	313
Bone Meals	303
Acid Phosphates	351
Cotton Seed Meals	875
Acid Phosphates, with Potash	46
Miscellaneous	69
Private Samples, etc	52
Total analyses	4,295

AMMONIATED SUPERPHOSPHATES AND GUANOS.

Ammoniated superphosphates and guanos constitute the chief bulk of the fertilizers consumed by the farmers of the Southern States. The term "complete fertilizer" is often applied to them on account of the fact that they contain all three of the most essential fertilizing constituents, and their range of adaptability is, in consequence, much greater than that of any of the partial manures. As might be supposed, there is great diversity in the composition of fertilizers of this class, both as regards the proportions of the fertilizing ingredients and also the forms in which they are supplied, the quantities of these essential constituents being so regulated as to correspond with the manufacturer's ideas as to the demands of our principal crops.

The following were analyzed:

Number of Analyses....	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen.......	Ammonia......	Potash........
		Water Soluble.	Reverted...	Insoluble...	Total.......	Available ..			
	Armour Fertilizer Works, Chicago, Ill.								
	CANE GROWER.								
	Guarantee	.....	.....	.....	......	8.00	3.29	4.00	.....
6	Average of 6 analyses	.....	.....	7.20	16.12	8.92	3.57	4.33	.....
	Maximum	.....	.....	8.12	16.95	9.54	3.74	4.54	.....
	Minimum	.....	.....	4.81	14.35	8.25	3.47	4.21	.....
	All up to guarantee.								
	Armour Fertilizer Works, Kansas City, Kan.								
	TANKAGE NO. 8.								
	Guarantee	.....	3.00	3.00	......	......	6.58	8.00	.....
1	Station No. 3490	.....	3.50	3.20	6.70	3.50	7.50	9.11	.....
	TANKAGE NO. 6.								
	Guarantee	.....	.....	.....	......	5.00	4.94	6.00	.....
1	Station No. 3707..............................	.....	9.25	6.60	15.85	9.25	5.31	6.44	.....
	Capital Fertilizer Co., Jackson, Miss.								
	NONPAREIL.								
	Guarantee	7.00	2.00	1.00	......	......	1.50	.....	2.00
8	Average of 8 analyses	6.69	3.07	.47	10.23	9.76	1.59	1.93	2.37
	Maximum	7.15	3.68	.60	10.95	10.53	1.66	2.01	2.68
	Minimum	6.08	2.47	.42	9.43	8.98	1.50	1.85	2.19
	One sample below guarantee in available phosphoric								

	acid.								
	Hazlehurst Oil Mill & Fertilizer Co., Hazlehurst, Miss.								
	IMPERIAL.								
	Guarantee	7.00	2.00	1.00	......	......	1.65	.....	1.50
51	Average of 51 analyses	8.40	2.98	1.19	12.57	11.38	1.92	2.32	2.15
	Maximum	10.00	3.87	1.47	13.42	11.95	2.09	2.54	2.48
	Minimum	7.03	1.55	.88	11.78	10.90	1.73	2.10	1.76
	All up to guarantee.								
	DIAMMOND "A" VEGETABLE GROWER.								
	Guarantee	6.00	.....	1.00	......	......	2.00	.....	4.00
5	Average of 5 analyses	4.99	2.14	.74	7.87	7.13	2.88	3.50	3.94
	Maximum	5.80	2.57	.94	8.35	7.46	3.62	4.39	4.84
	Minimum	3.85	1.66	.46	6.70	6.24	2.07	2.51	3.60
	SUPERIOR.								
	Guarantee	7.00	2.00	1.00	......	......	1.65	.....	1.50
6	Average of 6 analyses	8.16	3.04	1.67	12.87	11.20	1.84	2.23	1.98
	Maximum	8.70	3.47	2.38	14.55	12.17	1.99	2.41	2.20
	Minimum	7.60	2.60	.95	12.00	10.20	1.71	2.07	1.55
	All up to guarantee.								
	Homer Cotton Oil Co., Ltd., Homer, La.								
	CLAIBORN MIXTURE NO. 1.								
	Guarantee	8.00	2.00	1.00	......	......	1.75	.....	.50
17	Average of 17 analyses	6.85	5.13	1.78	13.76	11.98	2.21	2.68	.66
	Maximum	7.50	5.18	1.90	14.48	12.58	2.55	3.10	.82
	Minimum	6.20	5.08	1.67	13.05	11.38	1.87	2.68	.50
	All up to guarantee.								

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	Jackson Fertilizer Co., Jackson, Miss.								
	ROYAL "C" BRAND.								
	Guarantee	7.50	2.00	1.00	......	......	1.65	.....	1.80
8	Average of 8 analyses	8.32	2.79	1.48	12.59	11.16	11.11	1.78	2.89
	Maximum	9.10	3.50	1.70	13.10	11.80	1.95	2.37	2.00
	Minimum	7.57	2.30	1.30	12.85	10.15	1.64	1.99	1.78
	One sample below guarantee in nitrogen.								
	ROYAL "C" BRAND.								
	Guarantee	7.50	2.00	1.00	......	......	1.65	.....	1.80
46	Average of 46 analyses	8.15	2.85	1.50	12.50	11.00	1.84	2.23	1.90
	Maximum	8.85	3.51	2.06	13.76	12.16	2.45	2.98	1.98
	Minimum	7.70	2.42	1.12	11.90	9.87	1.19	1.44	1.80
	Two samples below guarantee in nitrogen.								
	GULF STATES GUANO.								
	Guarantee	7.50	2.00	1.00	......	......	1.65	.....	1.80
1	Station No. 55	7.92	3.24	1.46	12.62	11.16	1.92	2.32	2.22
1	Station No. 178	9.17	2.86	1.47	13.50	12.03	1.65	2.00	2.12
	LAMPTON'S RAW BONE SUPERPHOSPHATE.								
	Guarantee	7.50	2.00	1.00	......	......	1.65	.....	1.50
6	Average of 6 analyses	8.26	3.70	4.16	16.12	11.96	1.75	2.12	1.77
	Maximum	9.75	5.01	4.67	17.00	12.33	1.78	2.17	1.98

	Minimum	6.82	2.58	3.82	15.65	11.72	1.71	2.07	1.64
	All up to guarantee.								
	CHICAGO RAW BONE SUPERPHOSPHATE.								
	Guarantee	7.50	2.00	1.00	......	......	1.65	.....	1.50
14	Average of 14 analyses	7.34	3.82	3.65	14.81	11.16	1.71	2.07	1.60
	Maximum	8.52	5.12	5.03	15.50	11.88	1.81	2.19	1.84
	Minimum	6.60	2.44	2.51	14.23	10.48	1.65	2.00	1.18
	One sample below in potash.								
	FRUIT AND VEGETABLE.								
	Guarantee	3.00	3.00	1.00	......	......	3.00	.....	4.00
8	Average of 8 analyses	5.10	1.84	.94	7.88	6.94	2.90	3.52	3.99
	Maximum	5.40	2.17	1.13	8.47	7.57	3.12	3.79	4.22
	Minimum	4.67	1.58	.80	7.05	6.25	2.54	3.09	3.72
101	One sample below in nitrogen, and one below in potash.								
	Jarecki Chemical Co., Cincinnati, Ohio.								
	GILEAD PHOSPHATE.								
	Guarantee	.....	.....	3.00	......	3.00	2.47	.....	2.00
1	Station No. 1415	5.40	5.00	3.30	13.70	10.40	2.49	3.03	2.24
	Meridian Fertilizer Factory, Meridian, Miss.								
	HOME MIXTURE.								
	Guarantee	8.00	2.00	1.00	......	......	1.65	.....	2.00
9	Average of 9 analyses	7.01	2.98	1.21	11.20	9.99	1.81	2.19	1.97
	Maximum	8.13	3.37	1.48	11.79	10.51	1.97	2.38	2.23
	Minimum	6.25	2.38	.82	10.66	9.62	1.58	1.92	1.80
	Seven samples low in available phosphoric acid, nitrogen and potash, and two samples low in available phosphoric acid and potash.								

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	Meridian Fertilizer Factory—*Continued.*								
	HOME MIXTURE.								
	Guarantee	8.00	2.00	1.00	......	......	1.65	.....	2.00
73	Average of 73 analyses	6.91	3.18	1.30	11.39	10.09	1.92	2.32	1.96
	Maximum	7.57	4.01	2.06	12.50	11.34	2.07	2.51	2.57
	Minimum	5.60	2.82	.61	9.49	8.88	1.70	2.06	1.60
	Eighteen samples low in available phosphoric acid and forty-three low in potash.								
	SOLUBLE GUANO.								
	Guarantee	8.00	2.00	1.00	......	......	1.65	.....	2.00
1	Station No. 1674	6.45	3.56	.52	10.53	10.01	1.92	2.32	2.28
	MERIDIAN SOLUBLE GUANO.								
	Guarantee	8.00	2.00	1.00	......	......	1.65	.....	2.00
1	Station No. 2388	6.90	2.70	1.41	11.01	9.60	1.96	2.37	2.08
	MERIDIAN VEGETABLE GROWER.								
	Guarantee	4.00	2.00	1.00	......	......	2.50	.....	6.00
2	Stations Nos. 605-606	5.30	1.82	1.01	8.13	7.12	2.24	2.72	5.89
1	Station No. 1286	6.00	2.40	1.30	9.70	8.40	2.07	2.48	4.98
	VEGETABLE GROWER.								
	Guarantee	4.00	2.00	1.00	......	......	2.50	.....	6.00
1	Station No. 1680	5.15	2.03	1.47	8.65	7.18	2.38	2.89	6.26

	Minden Cotton Oil & Ice Co., Minden, La.								
	NORTH LOUISIANA STANDARD.								
	Guarantee	8.00	2.00	1.00	......	......	1.75	.....	.50
44	Average of 44 analyses	7.82	3.99	2.68	14.49	11.81	2.39	2.89	.65
	Maximum	8.16	4.83	3.20	15.27	12.66	2.78	3.38	.88
	Minimum	7.38	2.75	2.15	13.22	11.00	2.08	2.53	.50
	All samples up to guarantee.								
	New Orleans Acid & Fertilizer Co., Grètna, La.								
	BLOOD BONE AND BEEF.								
	Guarantee	7.00	2.00	2.00	......	......	1.65	.....	1.00
6	Average of 6 analyses	8.87	2.88	3.59	15.32	11.75	1.70	2.06	1.66
	Maximum	9.95	3.48	3.90	15.65	12.18	1.90	2.31	2.34
	Minimum	8.25	2.10	3.25	14.83	11.07	1.45	1.76	1.35
	Two samples below guarantee in nitrogen.								
	BLOOD BONE AND POTASH.								
	Guarantee	7.00	2.00	2.00	......	......	1.65	.....	1.00
70	Average of 70 analyses	8.94	2.84	3.45	15.23	11.78	1.90	2.31	1.31
	Maximum	9.25	3.50	4.50	15.70	12.70	2.50	3.06	1.81
	Minimum	8.10	2.30	1.60	14.30	11.30	1.67	2.02	.97
	Two samples below guarantee in potash.								
	CREOLE.								
	Guarantee	6.00	2.00	2.00	......	......	2.50	.....	.....
4	Station Nos. 4177 to 4180	10.60	2.05	2.10	14.75	12.65	2.68	3.26	.68
	All samples up to guarantee.								
	ECONOMIZER.								
	Guarantee	8.00	2.00	2.00	......	......	1.65	.....	2.00
7	Average of 7 analyses	7.54	3.82	2.46	13.82	11.36	2.14	2.28	2.64
	Maximum	8.12	4.55	2.75	14.60	12.22	2.35	2.85	3.30

Number of Analyses ...	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash ....
		Water Soluble	Reverted...	Insoluble...	Total	Available ..			
	New Orleans Acid & Fertilizer Co., Gretna, La.—*Continued.*								
	Minimum	6.38	2.61	2.20	13.15	10.40	1.95	2.37	2.24
	All samples up to guarantee.								
	GOLDSMITH'S IMPROVED MIXTURE.								
	Guarantee	7.00	2.00	2.00	......	......	1.65	.....	1.00
98	Average of 98 analyses	9.60	3.07	2.51	15.18	12.67	2.09	2.22	1.42
	Maximum	10.60	3.99	2.94	16.44	14.12	2.51	3.05	1.82
	Minimum	7.50	2.20	2.17	13.66	11.49	1.70	2.06	1.07
	All samples up to guarantee.								
	GOLD DUST.								
	Guarantee	7.00	2.00	2.00	......	......	1.65	.....	1.00
126	Average of 126 analyses	8.13	3.16	2.54	13.83	11.29	2.25	2.73	1.68
	Maximum	8.65	5.01	3.25	14.27	12.57	2.77	3.36	2.88
	Minimum	7.25	2.25	1.70	12.70	10.59	1.94	2.36	1.18
	All samples up to guarantee.								
	VEGETABLE GROWER.								
	Guarantee	6.00	1.25	2.00	......	......	2.80	.....	2.60
13	Average of 13 analyses	7.20	2.97	2.10	12.27	10.17	3.06	3.71	2.71
	Maximum	8.57	3.95	2.50	13.42	11.38	3.21	3.89	3.12
	Minimum	4.95	1.98	1.70	10.75	8.63	2.84	3.45	2.04
	Five samples below guarantee in potash,								

	SPECIAL SUGAR CANE GROWER, NO. 67.								
	Guarantee	5.00	2.00	2.00	.....	.....	5.00	.....	.....
18	Average of 18 analyses	6.15	2.74	2.45	11.34	8.89	5.29	6.40	.....
	Maximum	6.90	3.05	2.80	12.20	9.40	5.61	6.81	.....
	Minimum	5.40	2.50	2.10	10.55	8.45	4.97	6.03	.....
	Ten samples slightly below guarantee in nitrogen.								
	SPECIAL SUGAR CANE GROWER.								
	Guarantee	.....	.....	.....	.....	4.00	4.94	6.00	.....
8	Average of 8 analyses	3.17	2.94	1.04	7.15	6.11	6.68	8.12	.....
	Maximum	3.45	3.10	1.22	7.77	6.55	6.87	8.34	.....
	Minimum	2.70	2.63	.82	6.15	5.33	6.46	7.85	.....
	All samples up to guarantee.								
	SPECIAL FORMULA.								
	Guarantee	.....	.....	.....	9.00	7.00	5.00	6.07	.....
7	Average of 7 analyses	6.99	2.55	1.82	11.36	9.54	5.04	6.12	.....
	Maximum	7.28	2.60	2.80	12.20	9.88	5.11	6.20	.....
	Minimum	6.80	2.50	.85	10.73	9.35	4.97	6.03	.....
	One sample below guarantee in nitrogen.								
	SPECIAL SUGAR CANE GROWER NO. 106.								
	Guarantee	6.00	2.00	2.00	.....	.....	8.00	.....	.....
1	Station No. 3250	6.55	3.33	1.72	11.60	9.88	5.09	6.18	.....
	SPECIAL J. T. M. FORMULA.								
	Guarantee	.....	.....	.....	.....	5.00	5.76	7.00	.....
1	Station No. 1931	4.45	3.23	1.77	9.45	7.68	6.07	7.37	.....

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	PLANTERS FERTILIZER & MANUFACTURING Co., New Orleans, La.								
	PLANTERS COTTON AND CORN								
	Guarantee	6.50	2.50	2.00	......	......	1.65	.....	1.00
13	Average of 13 analyses	6.69	3.43	1.52	11.64	10.12	1.56	1.89	1.68
	Maximum	7.30	4.12	2.14	12.60	11.24	1.76	2.13	2.00
	Minimum	6.08	2.94	1.17	10.43	9.02	1.40	1.70	1.54
	Seven samples below guarantee in nitrogen.								
	PLANTERS COTTON AND CORN (Stubbs').								
	Guarantee	.....	.....	.....	......	7.00	1.65	.....	2.00
31	Average of 31 analyses	5.87	2.77	1.45	10.09	8.64	1.71	2.07	2.18
	All samples up to guarantee.								
	STUBBS' COTTON AND CORN.								
	Guarantee	.....	.....	.....	......	7.00	1.65	.....	2.00
199	Average of 199 analyses	5.88	2.82	1.38	10.08	8.70	1.66	2.01	2.32
	Maximum	6.45	3.27	1.75	11.05	9.72	1.87	2.25	4.46
	Minimum	5.30	2.15	.80	8.60	7.80	1.47	1.78	1.57
	One sample below guarantee in nitrogen, 124 samples below in potash, and 25 samples below in nitrogen and potash.								
	PLANTERS HIGH GRADE VEGETABLE GROWER.								
	Guarantee	5.00	2.00	.....	......	......	2.47	.....	3.50

	Twenty-four samples below guarantee in potash.								
8	Average of 8 analyses	5.62	3.09	1.10	9.81	8.71	2.52	3.07	4.20
	Maximum	6.00	5.25	1.41	12.17	10.80	2.62	3.18	4.87
	Minimum	4.80	2.26	.70	8.40	7.15	2.23	2.71	3.68
	Two samples below guarantee in nitrogen.								
	STUBBS' VEGETABLE.								
	Guarantee	5.00	2.00	1.50	8.50	7.50	2.47	3.00	3.00
5	Average of 5 analyses	5.61	3.38	1.14	10.13	8.99	2.03	2.47	4.15
	Maximum	5.65	4.61	1.47	11.65	10.18	2.59	3.14	4.46
	Minimum	5.57	2.15	.80	8.60	7.80	1.47	1.78	3.84
	Four samples below guarantee in nitrogen.								
	SPECIAL STRAWBERRY FERTILIZER.								
	Guarantee	.....	.....	.....	.....	5.00	1.65	.....	5.00
4	Average of 4 analyses	4.63	2.17	.94	7.74	6.80	1.85	2.24	4.95
	Maximum	4.90	2.38	1.10	7.96	6.86	1.91	2.32	5.23
	Minimum	4.35	1.96	.77	7.50	6.73	1.79	2.17	4.67
	One sample below guarantee in potash.								
	PLANTERS BLOOD, ACID PHOSPHATE AND KAINIT.								
	Guarantee	6.50	2.50	1.00	.....	.....	1.65	.....	1.50
1	Station No. 3321	7.13	3.33	.64	11.10	10.46	1.76	2.13	1.80
	CAPDEVILLE'S RAW BONE SUPERPHOSPHATE.								
	Guarantee	6.50	2.50	1.00	.....	.....	1.65	.....	1.50
1	Station No. 517	5.68	2.33	.53	8.72	8.19	2.14	2.59	1.76
	STUBBS' COTTON AND CORN.								
	Guarantee	.....	.....	.....	.....	7.00	1.65	.....	2.00
1	Station No. 262	5.96	3.83	1.82	11.61	9.79	1.83	2.22	2.22

Number of Analyses.....	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen.......	Ammonia.......	Potash.........
		Water Soluble......	Reverted...	Insoluble...	Total.......	Available ..			
	Planters Fertilizer & Manufacturing Co., New Orleans, La.—*Continued.*								
	PLANTERS C. & C. MAKER.								
	Guarantee	7.00	3.00	1.50	......	......	1.65	.....	2.00
2	Average of 2 analyses	7.05	3.50	1.25	11.80	10.55	1.50	1.82	1.61
	OAT FERTILIZER.								
	Guarantee	.....	.....	.....	.....	7.00	.82	1.00	3.00
1	Station No. 286	7.70	2.49	1.97	12.16	10.19	1.22	1.48	3.09
	PLANTERS YOUNG FRUIT TREE.								
	Guarantee	2.80	1.20	1.50	......	......	3.30	.....	1.00
1	Station No. 4224	5.75	3.85	1.05	10.65	9.60	1.74	2.11	4.24
	Below guarantee in ammonia.								
	HENRY M'CALL'S FORMULA.								
	Guarantee	3.60	1.40	1.00	......	......	3.71	.....	.50
1	Station No. 3079	3.90	2.95	1.00	7.85	6.85	3.48	4.23	.90
	Ruston Oil Mill & Fertilizer Co., Ruston, La.								
	COTTON KING GUANO.								
	Guarantee	6.00	2.00	1.00	......	......	1.75	.....	2.00
34	Average of 34 analyses	9.09	2.57	1.10	12.76	11.66	1.92	2.32	1.46
	Maximum	9.92	4.04	1.72	14.52	13.19	2.06	2.50	2.07
	Minimum	8.60	3.11	.52	12.70	12.00	1.75	2.15	1.08

	Shreveport Fertilizer Co., Shreveport, La.								
	CADDO COTTON.								
	Guarantee	6.00	2.00	1.00	......	......	2.05	.....	1.00
111	Average of 111 analyses	6.37	2.79	.86	10.02	9.16	2.01	2.44	1.12
	Maximum	6.80	3.47	1.16	11.10	10.05	2.13	2.57	1.45
	Minimum	5.59	2.13	.36	8.85	8.49	1.82	2.23	.82
	Sixteen samples below guarantee in nitrogen, nineteen below in potash, and eleven below in nitrogen and potash.								
	CORN AND VEGETABLE.								
	Guarantee	5.00	1.00	1.00	......	......	2.90	.....	1.00
1	Station No. 543	3.96	2.47	.92	7.35	6.43	2.89	3.51	1.26
	CORN AND VEGETABLE.								
	Guarantee	5.00	1.00	1.00	......	......	2.90	.....	1.00
17	Average of 17 analyses	4.45	2.50	.87	7.82	6.95	2.85	2.46	1.17
	Maximum	4.78	3.51	1.67	8.60	7.88	3.00	3.64	1.91
	Minimum	4.25	1.83	.71	7.35	6.53	2.59	3.15	.92
	Seven samples below guarantee in nitrogen, two below in potash, and two below in nitrogen and potash.								
	CORN AND VEGETABLE.								
	Guarantee	5.00	1.00	1.00	......	......	2.90	.....	1.00
18	Average of 18 analyses	4.52	2.56	.86	7.94	7.08	2.81	3.41	1.23
	Maximum	4.78	3.51	1.67	8.60	7.88	3.00	3.64	1.91
	Minimum	4.37	1.83	.55	7.55	6.53	2.59	3.15	1.05
	Four samples below guarantee in nitrogen.								
	STAR.								
	Guarantee	8.00	2.00	1.00	......	......	1.65	.....	2.00
12	Average of 12 analyses	7.71	3.00	.97	11.68	10.71	1.90	2.30	2.12

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	SHREVEPORT FERTILIZER Co., Shreveport, La.—*Continued.*								
	Maximum	8.70	3.53	1.11	12.48	11.43	2.07	2.51	2.32
	Minimum	6.50	2.71	.37	11.07	9.49	1.59	1.93	2.00
	Three samples below guarantee in available phosphoric acid, and one below in nitrogen.								
	CADDO VEGETABLE.								
	Guarantee	6.00	2.00	2.00	......	......	3.30	.....	4.00
1	Station No. 1091	5.45	3.11	.86	9.42	8.56	3.81	4.63	4.36
	Standard Guano and Chemical Manufacturing Co., New Orleans, La.								
	CHAMPION FARMERS CHOICE.								
	Guarantee	4.00	4.00	1.00	......	......	1.65	.....	1.50
201	Average of 201 analyses	5.87	2.54	1.12	9.53	8.41	1.93	2.34	2.22
	Maximum	7.87	3.99	2.62	13.31	11.86	2.20	2.68	2.62
	Minimum	4.30	1.03	.50	7.78	7.05	1.10	1.33	1.74
	Ninety-four samples below guarantee in available phosphoric acid, and two below in nitrogen.								
	STANDARD AMMONIATED RAW BONE SUPERPHOSPHATE.								
	Guarantee	4.00	5.00	1.00	......	......	1.65	.....	1.50
529	Average of 529 analyses	6.45	3.68	1.82	11.95	10.13	1.85	2.24	1.70

	Maximum	7.63	4.57	3.42	13.65	12.07	2.36	2.86	2.05
	Minimum	5.05	2.75	.70	9.73	9.01	1.58	1.92	1.14
	Five samples below guarantee in nitrogen, and fourteen samples below in potash.								
	HIGH GRADE SUGAR.								
	Guarantee	7.00	3.00	.....	......	......	2.50	.....	2.50
34	Average of 34 analyses	9.35	2.73	1.02	13.10	12.08	2.98	3.62	2.71
	Maximum	10.18	3.35	1.70	13.85	12.63	3.14	3.82	2.93
	Minimum	8.80	2.35	.69	12.52	11.90	2.85	3.46	2.52
	All samples up to guarantee.								
	MISSISSIPPI HOME GUANO.								
	Guarantee	5.00	5.00	1.00	......	......	1.65	.....	2.00
47	Average of 47 analyses	8.50	3.79	1.60	13.89	12.29	1.77	2.14	2.54
	Maximum	8.65	4.48	1.97	14.35	13.08	2.29	2.78	3.40
	Minimum	8.30	3.03	1.12	12.79	11.33	1.67	2.02	2.22
	All samples up to guarantee.								
	BLOOD, BONE AND MEAT.								
	Guarantee	4.00	4.25	1.00	......	......	1.70	.....	2.00
32	Average of 32 analyses	6.69	3.12	2.87	12.68	9.81	2.09	2.53	2.31
	Maximum	6.85	3.85	3.45	13.65	10.25	2.43	2.96	2.72
	Minimum	6.25	2.25	2.27	12.22	9.01	1.79	2.18	2.08
	All samples up to guarantee.								
	M'CALL'S FORMULA.								
	Guarantee	3.75	1.25	1.00	......	......	3.85	.....	1.00
38	Average of 38 analyses	4.16	2.43	.76	7.35	6.59	4.49	5.48	1.81
	Maximum	4.32	2.76	1.33	7.48	6.94	4.65	5.65	2.27
	Minimum	4.05	1.82	.34	7.25	6.14	4.41	5.36	1.60
	All samples up to guarantee.								

Number of Analyses.....	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen.......	Ammonia......	Potash.........
		Water Soluble......	Reverted...	Insoluble...	Total.......	Available ..			
	Standard Guano and Chemical Manufacturing Co., New Orleans, La.—*Continued.*								
	VEGETABLE.								
	Guarantee	4.00	2.00	1.00	......	......	3.00	.....	5.00
25	Average of 25 analyses	6.52	2.28	1.58	10.38	8.80	3.34	3.99	5.36
	Maximum	7.50	2.95	1.72	11.15	9.44	4.08	4.96	5.54
	Minimum	6.10	1.25	1.48	9.70	8.02	2.72	3.30	4.76
	One sample below guarantee in nitrogen, and ten below in potash.								
	CABBAGE PHOSPHATE.								
	Guarantee	4.00	5.00	.....	......	......	1.65	.....	1.50
12	Average of 12 analyses	6.70	2.62	1.53	10.85	9.32	2.93	3.56	4.82
	Maximum	7.43	2.88	1.68	11.67	10.12	3.40	4.13	5.60
	Minimum	6.10	2.17	1.25	10.12	8.67	2.61	3.17	3.76
	One sample below in available phosphoric acid.								
	VEGETABLE PHOSPHATE.								
	Guarantee	4.00	5.00	.....	......	......	1.65	.....	1.50
1	Station No. 28	7.35	1.91	1.74	11.00	9.26	2.60	3.16	5.17
	STANDARD AMMONIATED SOLUBLE GUANO.								
	Guarantee	4.00	4.00	.....	......	......	1.65	.....	1.50
1	Station No. 1530	4.83	3.37	.53	8.73	8.20	2.29	2.78	1.76

1	Station No. 4176	5.20	2.83	.95	8.98	8.03	2.15	2.61	2.08
	PELICAN RAW BONE GUANO.								
	Guarantee	4.00	4.00	1.00	.....	.....	1.65	.....	1.50
1	Station No. 2273	5.98	3.54	.66	10.18	9.52	2.02	2.45	2.11
	ORANGE TREE.								
	Special Formula.								
1	Station No. 3513	.....	11.43	6.12	17.55	11.43	2.98	3.62	3.13
	STRAWBERRY.								
	Special Formula.								
1	Station No. 4223	.....	10.06	11.71	21.77	10.06	3.10	3.76	3.05
	PRIVATE AND SPECIAL FORMULAS.								
	Guarantees not given.								
1	Private Formula Station No. 2261	4.17	3.50	.70	8.37	7.67	4.68	5.90	1.04
1	Special Formula Station No. 1669	1.95	2.88	.02	4.85	4.83	2.83	3.44	5.33
1	Special Formula Station No. 3080	8.30	3.69	1.76	13.75	11.99	.22	.26	3.36
3	Special Formula, average of 3 analyses	7.12	5.83	8.75	21.70	12.95	.33	.40	3.04
1	Special Formula No. 104, Station No. 4182	8.43	4.02	6.35	18.80	12.45	.60	.73	3.35
3	Special Rice, average of 3 analyses	5.65	3.23	.97	9.85	8.88	2.24	2.72	1.82
6	Special Rice, average of 6 analyses	5.75	2.83	1.12	9.70	8.58	2.39	2.90	2.17
1	Special Rice Formula (10-14), Station No. 2457	6.60	3.08	2.12	11.80	9.68	.63	.77	3.48
	Swift & Company, East St. Louis, Ill.								
	Guarantee	.....	.....	.....	.....	8.00	3.30	4.00	.....
1	Station No. 3706	.....	.....	2.55	11.40	8.85	3.68	4.47	.....
	Swift Fertilizer Works, Atlanta, Ga.								
	PLOW BOY.								
	Guarantee	7.00	2.00	1.00	.....	.....	.82	.....	1.00
1	Station No. 2260	7.80	4,16	2.34	14.30	11.96	.93	1.13	1,36

Number of Analyses.....	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Nitrogen.......	Ammonia......	Potash.........
		Water Soluble......	Reverted...	Insoluble...	Total.......	Available..			
	Swift Fertilizer Works, Atlanta, Ga.—*Continued.*								
	COTTON PLANT.								
	Guarantee	6.00	2.00	1.00	......	......	1.65	2.00	1.00
1	Station No. 1328	5.35	3.98	1.57	10.90	9.33	1.84	2.23	1.33
	Cudahy Packing Co., Kansas City, Kan.								
	REGULAR BLOOD AND BONE.								
	Guarantee	7.00	.....	5.00	......	......	5.00	.....	.....
6	Average of 6 analyses	.....	.....	11.07	18.64	7.57	5.24	6.36	.....
	Maximum	.....	.....	12.25	19.50	8.17	5.60	6.80	.....
	Minimum	.....	.....	9.85	17.02	7.00	5.00	6.07	.....
	All samples up to guarantee.								
	Virginia-Carolina Chemical Co., Memphis, Tenn.								
	SCOTT'S GOSSYPIUM PHOSPHO.								
	Guarantee	7.00	3.00	2.00	......	......	1.65	.....	2.00
46	Average of 46 analyses	6.14	4.31	2.00	12.45	10.45	2.00	2.43	2.12
	Maximum	8.05	5.41	3.92	13.92	11.48	2.52	3.06	2.45
	Minimum	4.90	3.43	.80	10.80	10.00	1.71	2.07	1.54
	Five samples below guarantee in potash.								
	SCOTT'S STATE STANDARD.								
	Guarantee	7.00	1.00	2.00	......	......	1.65	.....	2.00
6	Average of 6 analyses	5.46	3.15	1.12	9.73	8.61	1.64	1.99	2.08

	Maximum	6.80	5.15	1.72	10.75	9.23	1.73	2.10	2.26
	Minimum	3.70	2.00	.70	8.85	8.10	1.42	1.72	2.00
	All samples below guarantee in nitrogen.								
	SCOTT'S MEAL FORMULA.								
	Guarantee	7.00	3.00	2.00	......	......	.82	.....	1.00
7	Average of 7 analyses	3.31	7.37	2.28	12.96	10.68	.91	1.10	1.78
	Maximum	4.10	8.40	2.78	13.32	10.80	.96	1.16	2.30
	Minimum	2.30	6.56	1.85	12.65	10.54	.86	1.04	1.26
	All samples up to guarantee.								
	SCOTT'S AMMONIATED BONE.								
	Guarantee	6.00	3.00	2.00	......	......	1.65	.....	1.00
3	Average of 3 analyses	4.92	6.05	1.43	12.40	10.97	1.81	2.19	1.56
	Maximum	7.68	7.68	1.75	12.83	11.86	1.92	2.34	2.48
	Minimum	2.67	4.18	.97	12.10	10.35	1.65	2.00	1.07
	All samples up to guarantee.								
	ROYAL VEGETABLE FERTILIZER.								
	Guarantee	7.00	1.00	2.00	......	......	3.30	.....	4.00
4	Average of 4 analyses	6.01	2.80	3.84	12.65	8.81	2.90	3.52	3.56
	Maximum	7.25	3.25	5.50	14.60	9.73	3.36	4.08	4.24
	Minimum	4.95	2.43	.67	10.40	8.00	2.11	2.56	2.39
	Two samples below guarantee in nitrogen, and one sample below in nitrogen and potash.								
	ROYAL BLOOD, BONE AND POTASH.								
	Guarantee	7.00	3.00	2.00	......	......	.82	.....	1.00
8	Average of 8 analyses	8.96	2.77	4.22	15.95	11.73	1.27	1.53	1.40
	Maximum	13.00	3.63	6.57	19.36	14.14	1.73	2.10	2.20
	Minimum	6.39	1.14	1.11	12.07	10.02	1.02	1.24	1.06
	All samples up to guarantee.								

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID. Water Soluble	PHOSPHORIC ACID. Reverted	PHOSPHORIC ACID. Insoluble	PHOSPHORIC ACID. Total	PHOSPHORIC ACID. Available	Nitrogen	Ammonia	Potash
	Virginia-Carolina Chemical Co., Memphis, Tenn. —*Continued.*								
	ROYAL HIGH GRADE GUANO.								
	Guarantee	7.00	3.00	2.00	......	......	1.65	.....	2.00
7	Average of 7 analyses	7.47	3.25	3.60	14.32	10.72	1.70	2.06	2.06
	Maximum	9.03	3.62	5.08	15.70	11.82	1.96	2.38	2.80
	Minimum	6.60	2.79	1.02	11.18	10.16	1.48	1.80	1.70
	One sample below guarantee in nitrogen, three below in potash, and one below in nitrogen and potash.								
	ROYAL COTTON BOLL GUANO.								
	Guarantee	7.00	1.00	2.00	......	......	1.65	.....	2.00
11	Average of 11 analyses	6.29	3.19	4.33	13.81	9.48	1.61	1.95	1.98
	Maximum	6.80	3.53	7.04	16.55	10.18	1.75	2.12	2.20
	Minimum	5.85	2.48	.87	10.15	9.25	1.52	1.84	1.70
	Two samples below guarantee in nitrogen, one sample below in potash, and four below in nitrogen and potash.								
	ROYAL ANIMAL BONE GUANO.								
	Guarantee	6.00	3.00	2.00	......	......	1.65	.....	1.00
5	Average of 5 analyses	6.83	5.30	5.91	18.04	12.13	2.00	2.43	1.57
	Maximum	7.85	7.22	7.12	20.24	13.12	2.18	2.65	1.80

	Minimum	5.80	3.28	4.70	15.83	11.13	1.81	2.20	1.35
	All samples up to guarantee.								
	ROYAL FRUIT GROWER.								
	Guarantee	4.00	1.00	2.00	......	......	2.48	.....	8.00
1	Station No. 2850	8.78	3.20	1.02	13.00	11.98	2.32	2.81	5.91
1	Station No. 446	4.87	3.13	4.67	12.67	8.00	2.58	3.13	4.50
	ROYAL ANIMAL BONE.								
	Guarantee	6.00	3.00	2.00	......	......	1.65	.....	1.00
1	Station No. 1338	6.90	3.48	7.42	17.80	10.38	1.41	1.71	1.09
1	Station No. 1999	5.17	3.48	4.27	12.92	8.65	1.31	1.59	1.52
	MOBILE STANDARD.								
	Guarantee	7.00	1.00	2.00	......	......	1.65	.....	2.00
1	Station No. 1416	3.15	5.10	5.85	14.12	8.25	1.68	2.04	2.12
	ROYAL RAW BONE GUANO.								
	Guarantee	.....	.....	.....	......	10.00	.82	1.00	1.00
1	Station No. 460	7.52	4.55	5.08	17.15	12.07	1.12	1.37	.90

ACID PHOSPHATES.

Acid phosphates or superphosphates contain only one fertilizing constituent of value, viz.: phosphoric acid, but this ingredient is almost invariably present in three forms. Fertilizers of this class are made by treatment of bone ash, bone black, natural phosphates, coprolites, etc., with sulphuric acid. The phosphoric acid in these instances is combined with lime in the proportion of one part of phosphoric acid to three of lime. In this combination it is soluble only in acids. By treatment of the rock with sulphuric acid two parts of the lime are removed, leaving one part of phosphoric acid in combination with one part of lime, and in this form the phosphoric acid is readily soluble in water, and hence usually styled "soluble phosphoric acid." There is also formed simultaneously two parts of sulphate of lime (gypsum), which necessarily constitutes about one-half the weight of every acid phosphate made by this process. In England, where sulphuric acid is cheap, and where only the soluble form of phosphoric acid is recognized, acid phosphates yield upon analysis almost entirely soluble phosphoric acid. In this country, where sulphuric acid is dearer, and the reverted gives equal value with the soluble, acid phosphates contain all three forms of phosphoric acid. The change is brought about in the following manner: At the time of manufacture an amount of sulphuric acid insufficient to render soluble all of the phosphoric acid present is used, thus leaving in the mass some insoluble phosphates. This mass, containing both soluble and insoluble phosphates, is permitted to remain in bulk, and in the course of time a reaction takes place, which results in the formation of reverted phosphates. This reaction may be explained as follows: The phosphoric acid with one part of lime acts upon the phosphoric acid with three parts of lime, forming two molecules of phosphoric acid with two parts of lime. Therefore nearly every American acid phosphate contains all three forms of phosphoric acid. There are high grade acid phosphates on the market which are made by the action of phosphoric acid upon bone, ash and rock phosphates.

The following were analyzed:

Number of Analyses.....	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.				
		Water Soluble	Reverted...	Insoluble...	Total.......	Available ..
	Hazlehurst Oil Mill and Fertilizer Co., Hazlehurst, Miss.					
	ACID PHOSPHATE.					
	Guarantee	12.00	2.00	2.00	......	......
1	Station No. 2255	14.85	4.03	2.07	20.95	18.88
	Jackson Fertilizer Co., Jackson, Miss.					
	ACID PHOSPHATE.					
	Guarantee	10.00	2.00	1.00	......	......
19	Average of 19 analyses	14.80	3.83	1.43	20.06	18.63
	Maximum	15.70	4.65	3.07	21.00	19.90
	Minimum	13.80	2.38	.75	17.68	16.68
	All samples up to guarantee.					
	Meridian Fertilizer Factory, Meridian, Miss.					
	SOUTHERN ACID PHOSPHATE.					
	Guarantee	12.00	2.00	1.00	......	......
30	Average of 30 analyses	11.39	3.69	1.54	16.62	15.08
	Maximum	14.13	4.50	2.45	17.17	16.09
	Minimum	9.65	.94	1.08	15.92	14.20
	All samples up to guarantee.					
	ACID PHOSPHATE.					
	Guarantee	12.00	2.00	1.00	......	......
3	Average of 3 analyses	11.73	3.59	1.51	16.83	15.32
	Maximum	12.62	3.91	2.05	17.25	16.08

	Minimum	10.75	3.40	1.17	16.20	14.15
	All samples up to guarantee.					
	New Orleans Acid and Fertilizer Co., Gretna, La.					
	BLACK DIAMOND ACID PHOSPHATE.					
	Guarantee	10.00	2.00	2.00	......	......
57	Average of 57 analyses	12.45	3.75	2.68	18.88	16.20
	Maximum	13.80	5.50	4.20	20.20	18.58
	Minimum	11.75	2.13	1.62	18.60	14.63
	All samples up to guarantee.					
	CRESCENT CITY ACID PHOSPHATE.					
	Guarantee	10.00	2.00	2.00	......	......
39	Average of 39 analyses	12.80	4.14	3.17	20.11	16.94
	Maximum	13.75	6.05	3.74	20.80	17.95
	Minimum	11.90	2.40	2.08	18.21	15.47
	All samples up to guarantee.					
	ACID PHOSPHATE.					
	Guarantee	14.00	2.00	2.00	......	......
1	Station No. 187	13.10	5.30	2.80	21.20	18.40
1	Station No. 2736	13.55	3.32	2.96	19.83	16.87
	DISSOLVED BONE.					
	Guarantee	12.00	2.00	2.00	......	......
2	Average of 2 analyses	12.22	2.14	4.00	18.36	14.36
	DISSOLVED BONE.					
	Guarantee	12.00	2.00	2.00	......	......
1	Station No. 4175	5.15	9.16	2.45	16.76	14.31
	Planters Fertilizer Manufacturing Co., New Orleans, La.					
	ACID PHOSPHATE.					
	Guarantee	12.50	2.50	.....	......	......
35	Average of 35 analyses	12.03	4.00	1.43	17.46	16.03

Number of Analyses.....	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.				
		Water Soluble	Reverted...	Insoluble...	Total.......	Available ..
	Planters Fertilizer Manufacturing Co., New Orleans, La.—*Continued.*					
	Maximum	12.85	5.20	3.37	18.25	16.88
	Minimum	11.05	2.56	.39	15.90	15.00
	All samples up to guarantee.					
	Shreveport Fertilizer Co., Shreveport, La.					
	ACID PHOSPHATE.					
	Guarantee	14.00	2.00	2.00	......	......
15	Average of 15 analyses	14.42	3.73	1.41	19.56	18.15
	Màximum	15.65	4.88	2.22	20.80	19.88
	Minimum	13.85	3.24	.76	18.45	17.69
	All samples up to guarantee.					
	Guarantee	14.00	2.00	2.00	......	......
1	Station No. 749	15.10	4.75	1.75	21.60	19.85
	Guarantee	14.00	2.00	2.00	......	......
1	Station No. 1952	14.65	3.30	1.90	19.85	17.95
	Guarantee	14.00	2.00	2.00	......	......
1	Station No. 1954	12.20	3.93	2.87	19.00	16.13
	Standard Guano and Chemical Manufacturing Co., New Orleans, La.					
	ACID PHOSPHATE.					
	Guarantee	10.00	2.00	1.00	......	......
120	Average of 120 analyses	12,01	4.62	1.65	18.28	16,63

	Maximum	13.45	5.52	2.37	18.80	17.47
	Minimum	10.85	3.09	.97	18.15	15.78
	All samples up to guarantee.					
	Virginia-Carolina Chemical Co., Memphis, Tenn.					
	SCOTT'S HIGH GRADE ACID PHOSPHATE.					
	Guarantee	12.00	2.00	2.00	......	......
16	Average of 16 analyses	8.27	6.88	2.57	17.72	15.15
	Maximum	11.98	8.97	3.65	19.00	15.88
	Minimum	6.50	3.90	2.15	17.35	14.15
	All samples up to guarantee.					
	ROYAL ACID PHOSPHATE.					
	Guarantee	12.00	2.00	2.00	......	......
6	Average of 6 analyses	6.10	8.81	2.00	16.91	14.91
	Maximum	9.35	12.02	2.55	19.00	16.43
	Minimum	1.42	6.18	.50	14.80	13.44
	All samples up to guarantee.					
	MOBILE I. X. L. ACID PHOSPHATE.					
	Guarantee	10.00	2.00	2.00	......	......
1	Station No. 1531	7.98	5.26	1.81	15.05	13.24
1	Station No. 2735	8.20	5.88	1.77	15.85	14.08

COTTON SEED MEAL.

This, to the Southern farmer, is the cheapest and most easily obtainable form of nitrogen. Although it has acquired an extensive use as a fertilizer throughout the whole State, it has been exempted from the operations of the fertilizer law by virtue of its employment as a feeding stuff.*

On account of the presence of quite appreciable quantities of hulls in many samples of meal found upon the market, it is very essential that great care should be observed in the purchase of this article. Hulls can easily be detected by the non-homogeneous appearance of the meal containing them, and also by passing a small quantity of the meal through an ordinary sifter.

The best undamaged meal has a bright yellow color and is dry and pulverulent.

The damaged meal is invariably darker in color, and though rendered unfit for use as a feed stuff, does not lose any of its value for fertilizing purposes.

Frequent requests are made for the comparative values of cotton seed meal, cotton seed and cotton seed huls. To furnish a basis for comparison, the analyses of average samples of cotton seed, cotton seed meal, and cotton seed hulls, are here given and their valuation per ton by the tariff of prices given on page ——.

ANALYSES.

	Nitrogen.	Phosphoric Acid.	Potash.	Value Per Ton.
Cotton seed	3.007	1.3	1.2	$11.52
Cotton seed meal	7.007	3.0	2.0	26.02
Cotton seed hulls	.707	.25	1.0	3.37

These are values for fertilizing purposes only and have no reference to feeding value.

The average analysis of ashes of cotton seed hulls will show 9.17 phosphoric acid and 23.47 potash. With these comparative values a farmer can decide from prevailing prices of seed, meal and hulls whether it is expedient to sell his seed and buy meal and hulls or to use them as a fertilizer.

The following analyses of cotton seed meals were made:

* Note—By amending act published elsewhere in this Bulletin cotton seed meal sold for fertilizing purposes is now subject to provisions of the fertilizer law.

Number of Analyses....	NAME OF MANUFACTURER.	Nitrogen........	Ammonia........
	Bastrop Oil and Fertilizer Works, Bastrop, La.		
	Guarantee	7.00	8.50
6	Average of 6 analyses	7.05	8.56
	All samples up to guarantee		
	Belzoni Oil Co., Belzoni, Miss. ..		
	Guarantee	6.58	8.00
1	Station No. 3607	6.74	8.19
1	Station No. 4103	6.61	8.03
	Caddo Delinter and Oil Co., Shreveport, La.		
	Guarantee	4.75	5.77
5	Average of 5 analyses	4.79	5.82
	Maximum	4.81	5.84
	Minimum	4.76	5.78
	All samples up to guarantee		
	Canton Oil Mill, Canton, Miss.		
	Guarantee	5.00	6.06
1	Station No. 2935	7.22	8.76
	Capital City Oil Mill Co., Baton Rouge, La.		
	Guarantee	6.00	7.29
29	Average of 29 analyses	7.02	8.52
	Maximum	7.76	9.42
	Minimum	6.66	8.09
	All samples up to guarantee		
	Guarantee	6.59	8.00
4	Average of 4 analyses	7.18	8.72
	Maximum	7.51	9.12
	Minimum	6.85	8.32
	All samples up to guarantee		
	Centerville Cotton Oil Co., Centerville, Miss.		
	Guarantee	6.00	7.29
3	Average of 3 analyses	7.73	9.48
	Maximum	8.00	9.71
	Minimum	7.45	9.05
	All samples above guarantee.		
	Columbia Cotton Oil Co., New Orleans, La.		
	Guarantee	6.00	7.29
4	Average of 4 analyses	6.97	8.46
	All samples above guarantee.		
	Concordia Oil Mill Co., Vidalia, La.		
	Guarantee	7.00	8.50

Number of Analyses.....	NAME OF MANUFACTURER.	Nitrogen........	Ammonia......
6	Average of 6 analyses	6.78	8.24
	All samples below guarantee.		
	Feliciana Oil Mill, St. Francisville, La.		
	Guarantee	6.00	7.29
15	Average of 15 analyses	6.98	8.48
	Maximum	7.09	8.61
	Minimum	6.85	8.32
	All samples up to guarantee		
	Gloster Oil Works, Gloster, Miss.		
	Guarantee	6.00	7.29
1	Station No. 3427	6.91	8.39
1	Station No. 3514	7.52	9.12
	Guarantee	6.58	8.00
1	Station No. 2652	7.54	9.16
1	Station No. 4126	7.33	8.90
	Grayson Cotton Oil Mill, Sherman, Tex.		
	Guarantee	6.58	8.00
1	Station No. 4152	7.31	8.87
	Breaux Bridge Oil Works, Breaux Bridge, La.		
	Guarantee	7.37	8.96
34	Average of 34 analyses	7.52	9.13
	Maximum	7.73	9.40
	Minimum	7.37	8.96
	All samples up to guarantee		
	Homer Cotton Oil Co., Homer, La.		
	Guarantee	6.00	7.29
34	Average of 34 analyses	7.19	8.73
	Maximum	7.44	9.07
	Minimum	6.83	8.30
	All samples up to guarantee.		
	Hollywood Cotton Oil Co., Hollywood, Miss.		
	Guarantee	6.58	8.00
1	Station No. 4114	6.12	7.43
	Itta Bena Cotton Oil Co., Itta Bena, Miss.		
	Guarantee	6.00	7.29
1	Station No. 3694	6.90	8.38
1	Station No. 4120	7.38	8.96
	Guarantee	6.00	7.29
1	Station No. 1852	7.09	8.61

Number of Analyses....	NAME OF MANUFACTURER.	Nitrogen........	Ammonia......
	Minden Cotton Oil and Ice Co., Minden, La.		
	Guarantee	6.50	7.90
49	Average of 49 analyses	7.54	9.16
	Maximum	7.66	9.30
	Minimum	7.42	9.01
	All samples above guarantee.		
	Mississippi Cotton Oil Co., Natchez, Miss.		
	Guarantee	6.59	8.00
10	Average of 10 analyses	7.18	8.61
	All samples up to guarantee.		
	New Roades Oil Mill and Mfg. Co., New Roades, La.		
	Guarantee	6.00	7.29
21	Average of 21 anaylses	6.82	8.28
	Maximum	6.96	8.45
	Minimum	6.65	8.08
	All samples up to guarantee.		
	Guarantee	6.58	8.00
10	Average of 10 analyses	6.71	8.15
	Maximum	6.78	8.24
	Minimum	6.64	8.07
	All samples up to guarantee.		
	New Iberia Milling and Development Co., Ltd., New Iberia, La.		
	Guarantee	6.00	7.29
47	Average of 47 analyses	7.39	8.98
	Maximum	7.75	9.41
	Minimum	6.70	8.14
	All samples up to guarantee.		
	N. O. C. S. M. & M. Co., New Orleans, La.		
	Guarantee	6.58	8.00
1	Station No. 4104	6.51	7.91
	New Orleans Acid and Fertilizer Co., Gretna, La.		
	Guarantee	6.58	8.00
3	Average of 3 analyses	6.95	8.44
	Maximum	7.15	8.68
	Minimum	6.57	7.99
	All samples up to guarantee.		
	Planters Oil Mill, Monroe, La.		
	Guarantee	6.58	8.00

Number of Analyses	NAME OF MANUFACTURER.	Nitrogen	Ammonia
16	Average of 16 analyses	6.93	8.42
	Maximum	7.09	8.60
	Minimum	6.72	8.16
	All samples up to guarantee.		
	Guarantee	6.58	8.00
1	Station No. 1181	6.91	8.39
	Guarantee	6.58	8.00
1	Station No. 1482	6.72	8.16
	Guarantee	6.58	8.00
9	Average of 9 analyses	6.71	8.15
	Maximum	6.74	8.19
	Minimum	6.69	8.13
	All samples up to guarantee.		
	Guarantee	6.58	8.00
3	Average of 3 analyses	6.83	8.30
	All samples up to guarantee.		
	Planters Fertilizer Manufacturing Co., New Orleans, La.		
	Guarantee	6.18	7.51
2	Average of 2 analyses	7.44	9.03
	All samples up to guarantee.		
	Guarantee	6.58	8.00
1	Station No. 648	7.41	9.00
	Guarantee	7.00	8.50
2	Average of 2 analyses	7.04	8.55
	All samples up to guarantee.		
	Port Gibson Oil Works, Port Gibson, Miss.		
	Guarantee	5.00	6.07
6	Average of 6 analyses	7.06	8.57
	Maximum	7.28	8.84
	Minimum	6.73	8.18
	All samples up to guarantee.		
	Peoples Oil Co., Lafayette, La.		
	Guarantee	7.71	9.36
18	Average of 18 analyses	7.83	9.51
	Maximum	7.99	9.70
	Minimum	7.66	9.30
	One sample below guarantee.		
	Red River Oil Co., Ltd., Alexandria, La.		
	Guarantee	6.17	7.50

Number of Analyses	NAME OF MANUFACTURER.	Nitrogen	Ammonia
59	Average of 59 analyses	6.79	8.25
	Maximum	7.02	8.52
	Minimum	6.47	7.76
	All samples up to guarantee.		
	Guarantee	6.59	8.00
30	Average of 30 analyses	6.92	8.40
	Maximum	7.08	8.60
	Minimum	6.65	8.08
	All samples up to guarantee.		
	Guarantee	6.75	8.20
1	Station No. 1843	7.08	8.60
	Guarantee	6.79	8.25
13	Average of 13 analyses	6.82	8.29
	Maximum	7.03	8.54
	Minimum	6.68	8.12
	Four samples below guarantee.		
	Raccourci Cotton Oil Co., Batchelor, La.		
	Guarantee	6.00	7.29
6	Average of 6 analyses	6.87	8.34
	Maximum	7.07	8.59
	Minimum	6.80	8.26
	All samples up to guarantee.		
	Guarantee	6.59	8.00
1	Station No. 1845	7.08	8.60
	Ruston Oil Mill and Fertilizer Co., Ruston, La.		
	Guarantee	7.00	8.50
12	Average of 12 analyses	7.27	8.82
	Maximum	7.33	8.90
	Minimum	7.20	8.74
	All samples up to guarantee.		
	St. Landry Cotton Oil Co., Opelousas, La.		
	Guarantee	6.59	8.00
89	Average of 89 analyses	7.38	8.96
	Maximum	7.53	9.14
	Minimum	7.17	8.70
	All samples up to guarantee.		
	St. Martin Oil Works, St. Martinsville, La.		
	Guarantee	7.00	8.50
29	Average of 29 analyses	7.23	8.77
	Maximum	7.55	9.17

Number of Analyses....	NAME OF MANUFACTURER.	Nitrogen.......	Ammonia......
	Minimum	7.00	8.50
	All samples up to guarantee.		
	Sonia Cotton Oil Co., Ltd., Alexandria, La.		
	Guarantee	6.59	8.00
71	Average of 71 analyses	7.21	8.75
	Maximum	7.38	8.96
	Minimum	6.90	8.38
	All samples up to guarantee.		
	Guarantee not given.		
1	Station No. 3720	5.51	6.69
	Southern Cotton Oil Co., Houston, Tex.		
	Guarantee	7.00	8.50
1	Station No. 1660	7.76	9.42
1	Station No. 2111	7.57	9.19
	Summit Gin and Improvement Co., Summit, Miss.		
	Guarantee	6.00	7.29
8	Average of 8 analyses	7.80	9.47
	Maximum	8.02	9.74
	Minimum	7.64	9.28
	All samples up to guarantee.		
	Guarantee	6.00	7.29
1	Station No. 603	8.05	9.77
1	Station No. 4115	7.71	9.36
	Shreveport Delinter and Oil Co., Shreveport, La.		
	Guarantee	4.75	5.77
1	Station No. 2550	6.72	8.16
	Shreveport Cotton Oil Co., Bossier City, La.		
	Guarantee	6.00	7.29
2	Average of 2 analyses	7.14	8.67
	Union Cotton Oil Co., W. Monroe, La.		
	Guarantee	6.59	8.00
38	Average of 38 analyses	6.80	8.26
	Maximum	7.20	8.75
	Minimum	6.57	7.98
	All samples up to guarantee.		
	Guarantee	6.97	8.46
1	Station No. 515	6.68	8.12
	Union Oil Co., Gretna, La.		
	Guarantee	6.59	8.00

Number of Analyses.....	NAME OF MANUFACTURER.	Nitrogen........	Ammonia......
5	Average of 5 analyses	6.88	8.36
	Maximum	6.89	8.37
	Minimum	6.87	8.34
	Union Oil Co., Bunkie, La.		
	Guarantee	6.59	8.00
90	Average of 90 analyses	7.04	8.55
	Maximum	7.74	9.40
	Minimum	5.89	7.15
	Eleven samples below guarantee.		
	Union Oil Co., Torras, La.		
	Guarantee	6.59	8.00
22	Average of 22 analyses	7.15	8.68
	Maximum	7.52	9.15
	Minimum	6.84	8.31
	All samples up to guarantee.		
	Guarantee	6.59	8.00
4	Average of 4 analyses	6.96	8.45
	Maximum	7.13	8.58
	Minimum	6.70	8.14
	All samples up to guarantee.		
	Union Oil Co., Vidalia, La.		
	Guarantee	6.59	8.00
15	Average of 15 analyses	6.90	8.38
	Maximum	7.14	8.67
	Minimum	6.64	8.07
	All samples up to guarantee.		
	Union Oil Co., New Orleans, La.		
	Guarantee	6.59	8.00
1	Station No. 4121	7.06	8.57
	Union Oil Mill, Shreveport, La.		
	Guarantee	6.59	8.00
6	Average of 6 analyses	6.65	8.08
	All samples up to guarantee.		
	Woodville Oil and Manufacturing Co., Woodville, Miss.		
	Guarantee	6.00	7.29
1	Station No. 947	6.80	8.25
	Guarantee	6.28	7.63
1	Station No. 1853	6.78	8.24
	Whitesboro Cotton Oil Co., Whitesboro, Tex.		
	Guarantee	6.59	8.00

Number of Analyses	NAME OF MANUFACTURER.	Nitrogen	Ammonia
4	Average of 4 analyses	7.80	9.47
	All samples up to guarantee.		
	Lake End Cotton Oil Co., Lake End, La.		
	Guarantee	6.00	7.29
3	Average of 3 analyses	6.53	7.94
	Maximum	6.64	8.07
	Minimum	6.46	7.85
	All samples up to guarantee.		
	Lafayette Cotton Oil Co., Lafayette, Miss.		
	Guarantee	6.00	7.29
1	Station No. 3695	6.79	8.25
	H. T. Lawler & Son, New Orleans, La.		
	Guarantee	6.59	8.00
1	Station No. 3605	6.81	8.27
	Hazlehurst Oil Mill and Fertilizer Co., Hazlehurst, Miss.		
	Guarantee	5.00	6.07
3	Average of 3 analyses	7.84	9.52
	Maximum	7.98	9.69
	Minimum	7.84	9.52
	All samples up to guarantee.		
	Guarantee	6.59	8.00
1	Station No. 599	7.66	9.30
1	Station No. 602	7.40	8.99
	Producers Cotton Oil Co., Yazoo City, Miss.		
	Guarantee	5.00	6.07
1	Station No. 604	7.41	9.00
	Jackson Fertilizer Co., Jackson, Miss.		
	Guarantee	6.50	7.90
1	Station No. 2109	7.10	8.62
	Shreveport Fertilizer Co., Shreveport, La.		
	Guarantee	4.75	5.77
5	Average of 5 analyses	4.50	5.41
	Five samples below guarantee.		
	Standard Guano and Chemical Manufacturing Co., New Orleans, La.		
	Guarantee	7.00	8.50
1	Station No. 4211	7.26	8.81

TANKAGE.

The fertilizer has grown rapidly in favor since its introduction into this State, and is each year becoming more largely in demand. It consists chiefly of waste products from slaughter houses, and is a mixture of partly cooked bone and meat, deposited in tanks in which the refuse from the butcher is treated to separate the grease. It ordinarily contains good percentages of both nitrogen and phosphoric acid, the proportions of each, in general, varying almost inversely as the quantity of the other. The relative proportions of nitrogen and phosphoric acid having such wide limits of variation, this class of goods, of course, exhibits a corresponding wide range in value for fertilizing uses. When a considerable excess of bone is present, the proportion of phosphoric acid is largely above that of the nitrogen, while with an excess of meat, the contents of nitrogen becomes large and that of phosphoric acid becomes comparatively small. In the latter case, the action of both ingredients has been found to be more satisfactory. The phosphoric acid in the tankage, being derived principally from bone, is chiefly the insoluble form and its value is largely dependent upon the degree of fineness of division of the particles, a well pulverized sample responding more readily to the needs of the plant. Purchasers of fertilizers of this class should always buy upon a guarantee of definite percentages of nitrogen and phosphoric acid, as their varying composition renders almost indispensable a knowledge of the proportions of their constituents. The bone present should also be in a very finely divided condition.

Since tankage is valuable chiefly for the nitrogen or ammonia, care should be taken in buying this fertilizer to secure the highest percentage of this ingredient. Guarantees of 9 per cent. ammonia and 20 per cent. bone phosphate (which is about equivalent to 9 per cent. phosphoric acid) can be secured from any dealer in this class of fertilizers, and no lower content of nitrogen should be bought from an economical standpoint, since the freight from the Western packing houses to the consumer is the same per ton on all kinds, and the higher the content the cheaper the nitrogen per pound to the consumer when the cost of freight is added.

The following samples were analyzed:

Number of Analyses.....	NAME OF MANUFACTURER AND BRAND.	Total Phosphoric Acid..	Nitrogen......	Ammonia .....
	Guarantee	......	4.94	6.00
3	Average of 3 analyses	15.72	5.08	6.17
	Maximum	16.50	5.17	6.27
	Minimum	14.50	5.03	6.11
	All samples up to guarantee.			
	Crescent City Stock Yards and Slaughter House Co., New Orleans, La.			
	Guarantee	......	7.82	9.50
5	Average of 5 analyses	11.33	6.42	7.79
	Maximum	12.95	6.87	8.25
	Minimum	10.50	5.84	7.09
	Five samples below guarantee in nitrogen.			
	Fort Worth Packing and Provision Co., Fort Worth, Texas.			
	Texas.			
	Guarantee	9.16	6.00	7.29
1	Station No. 1839	18.37	5.36	6.50
1	Station No. 1939	15.75	5.81	7.05
	Two samples below guarantee.			
	Guarantee	......	6.00	7.29
1	Station No. 3699	10.75	7.11	8.63
	Guarantee	......	6.59	8.00
5	Average of 5 analyses	12.13	5.81	7.05
	Maximum	13.50	6.11	7.42
	Minimum	8.23	5.37	6.51
	Five samples below guarantee in nitrogen.			
	Guarantee	......	6.59	8.00
1	Staton No. 2515	9.07	7.73	9.39
1	Station No. 2516	11.75	7.12	8.64
	These two samples had a guarantee of 12 per cent. of potash, evidently an error, and only a trace of potash was found.			
	Cudahy Packing Co., Kansas City, Kan.			
	REGULAR BLOOD AND BONE.			
	Guarantee	12.00	5.00	6.07
10	Average of 10 analyses	16.97	5.58	6.75
	Maximum	18.45	5.88	7.14
	Minimum	15.65	5.23	6.35
	All samples up to guarantee.			

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	Total Phosphoric Acid	Nitrogen	Ammonia
	Swift & Co.			
	Guarantee	13.74	4.94	6.00
1	Station No. 43	15.95	5.11	6.20
1	Station No. 79	16.75	4.61	5.60
	Guarantee	11.45	5.76	7.00
15	Average of 15 analyses	11.22	6.37	7.83
	Maximum	17.53	7.43	9.03
	Minimum	6.27	4.75	5.77
	One sample below guarantee in nitrogen, and six below in total phosphoric acid.			
	Guarantee	9.16	6.58	8.00
79	Average of 79 analyses	10.80	6.87	8.34
	Maximum	14.32	7.57	9.19
	Minimum	5.93	6.22	7.55
	Sixteen samples below guarantee in total phosphoric acid, fifteen below in nitrogen, and one below in total phosphoric acid and nitrogen.			
	Guarantee	6.87	7.41	9.00
63	Average of 63 analyses	9.12	7.36	8.94
	Maximum	12.95	8.18	9.93
	Minimum	5.75	6.49	7.89
	Five samples below guarantee in total phosphoric acid, and thirty-two below in nitrogen.			
	Guarantee	6.87	8.23	10.00
122	Average of 122 analyses	7.50	8.07	9.79
	Maximum	13.05	8.80	10.68
	Minimum	5.35	6.96	8.45
	Thirteen below guarantee in total phosphoric acid, forty-nine below in nitrogen, and twenty-nine below in nitrogen and total phosphoric acid.			
	Guarantee	4.58	9.06	11.00
4	Average of 4 analyses	5.66	8.91	10.82
	Maximum	6.25	9.16	11.12
	Minimum	5.30	8.51	10.33
	Two samples below guarantee in nitrogen.			

BONE MEAL.

Bones pulverized to a greater or less degree of fineness are sold as "Bone Meal," "Bone Dust," "Ground Bone." etc., and are extensively used in some countries for fertilizing purposes. They have, as yet, acquired but little favor in the South, and but few brands were on the market this season. As their utility depends largely upon the state of division of their particles, both a mechanical and chemical examination are necessary in determining their value.

In addition to the phosphoric acid found in bone black and bone oil, ground bone contains a good part of nitrogen derived from the gelatinous matter present in the raw substance.

The following were analyzed:

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	Total Phosphoric Acid...	Nitrogen......	Ammonia .....
	Crescent City Stock Yards and Slaughter House Co., New Orleans, La.			
	CRESCENT CITY GROUND BONE.			
	Guarantee	24.58	4.20	5.09
4	Average of 4 analyses	25.42	3.62	4.39
	Maximum	26.20	3.87	4.69
	Minimum	24.65	3.37	4.06
	Four samples below guarantee in nitrogen.			
	Jackson Fertilizer Co., Jackson, Miss.			
	BONE MEAL.			
	Guarantee	25.00	2.50	3.04
9	Average of 9 analyses	25.11	3.56	4.32
	Maximum	28.06	4.06	4.93
	Minimum	17.75	2.62	3.18
	One sample below guarantee in total phosphoric acid.			
	New Orleans Acid and Fertilizer Co., Gretna, La.			
	BONE MEAL.			
	Guarantee	20.00	3.00	3.64
2	Average of 2 analyses	23.40	3.90	4.73
	All samples up to guarantee.			

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	Total Phosphoric Acid	Nitrogen	Ammonia
	Guarantee	20.00	3.00	3.64
23	Average of 23 analyses	23.34	3.21	3.89
	Maximum	25.60	3.92	4.76
	Minimum	20.85	2.35	2.86
	Ten samples below guarantee in nitrogen.			
	Guarantee	20.00	3.00	3.64
1	Station No. 4049	25.27	2.82	3.42
	Below guarantee in nitrogen.			
	Standard Guano and Chemical Manufacturing Co., New Orleans, La.			
	PURE RAW GROUND BONE.			
	Guarantee	18.50	2.50	3.04
250	Average of 250 analyses	21.51	3.61	4.38
	Maximum	23.10	4.44	5.39
	Minimum	20.30	3.06	3.71
	All samples up to guarantee.			
	FINE GROUND BONE.			
	Guarantee	18.50	2.50	3.04
12	Average of 12 analyses	22.70	3.55	4.31
	Maximum	25.25	3.97	4.81
	Minimum	21.13	3.06	3.71
	All samples up to guarantee.			
	CHICAGO GROUND BONE.			
	Guarantee	18.50	2.50	3.04
1	Station No. 177	19.10	3.48	4.23
	Virginia-Carolina Chemical Co., Memphis, Tenn.			
	RAW GROUND BONE.			
	Guarantee	20.00	3.30	4.00
1	Station No. 326	22.36	3.95	4.79

FERTILIZERS CONTAINING PHOSPHORIC ACID AND POTASH.

The past season a few fertilizers containing only available phosphoric acid and potash were sold in the State. The following were analyzed:

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	PHOSPHORIC ACID.					Potash
		Water Soluble	Reverted	Insoluble	Total	Available	
	New Orleans Acid and Fertilizer Co., Gretna, La.						
	DISSOLVED BONE AND POTASH.						
	Guarantee	8.00	2.00	2.00	......	......	2.00
28	Average of 28 analyses	9.28	4.68	2.88	16.84	13.96	2.35
	Maximum	11.26	5.18	3.51	18.82	16.44	3.04
	Minimum	5.92	4.19	2.46	12.65	10.19	2.00
	All samples up to guarantee.						
	Standard Guano and Chemical Manufacturing Co., New Orleans.						
	DISSOLVED BONE AND POTASH.						
	Guarantee not given.						
3	Average of 3 analyses	6.24	5.52	6.43	18.19	11.76	1.86
	STERN'S DISSOLVED BONE AND POTASH.						
	Guarantee not given.						
1	Station No. 240	3.23	2.26	1.26	6.84	5.58	2.19
	Virginia-Carolina Chemical, Co., Memphis, Tenn.						
	ROYAL COMPOUND.						
	Guarantee	8.00	2.00	2.00	......	......	2.00
9	Average of 9 analyses	4.46	6.83	1.39	12.68	11.29	2.53
	Maximum	7.45	9.80	2.10	13.40	12.25	3.17
	Minimum	2.45	4.62	.71	11.98	9.88	2.19
	One sample below guarantee in available phosphoric acid.						

	ROYAL POTASH COMPOUND.						
	Guarantee	8.00	2.00	2.00	......	......	4.00
2	Average of 2 analyses	4.05	6.40	1.63	12.08	10.45	4.48
	SCOTT'S POTASSO-PHOSPHO.						
	Guarantee	10.00	2.00	2.00	......	......	2.00
3	Average of 3 analyses	5.50	6.55	.97	13.02	12.05	2.13
	Maximum	7.25	8.26	1.16	13.17	12.10	2.22
	Minimum	3.75	4.85	.77	12.87	12.01	2.04
	All samples up to guarantee.						

MISCELLANEOUS FERTILIZERS.

Under this head are included the analyses of fertilizing materials not given in preceding tables. The following were analyzed:

Number of Analyses	NAME OF MANUFACTURER AND BRAND.	Nitrogen	Ammonia	Potash
	Jackson Fertlizer Co., Jackson, Miss.			
	KAINIT.			
	Guarantee	......	......	12.00
3	Average of 3 analyses	......	......	12.19
	Maximum	......	......	12.68
	Minimum	......	......	11.70
	Two samples below guarantee.			
	Standard Guano and Chemical Manufacturing Co.			
	KAINIT.			
	Guarantee	......	......	12.00
21	Average of 21 analyses	......	......	13.35
	Maximum	......	......	13.48
	Minimum	......	......	12.94
	MURIATE OF POTASH.			
	Guarantee	......	......	49.00
7	Average of 7 analyses	......	......	50.65
	Maximum	......	......	52.21
	Minimum	......	......	48.60
	NITRATE OF SODA.			
	Guarantee	15.00	......	......
8	Average of 8 analyses	15.84	19.23	......
	Maximum	16.07	19.53	......
	Minimum	15.67	19.02	......
	SULPHATE OF AMMONIA.			
	Guarantee not given.			
1	Station No. 981	21.00	25.50	......
1	Station No. 2679	20.77	25.22	......
	SULPHATE OF POTASH.			
	Guarantee	......	......	48.00
4	Average of 4 analyses	......	......	47.21
	Maximum	......	......	47.21
	Minimum	......	......	47.20

Number of Analyses....	NAME OF MANUFACTURER AND BRAND.	Nitrogen........	Ammonia.......	Potash.........
	Swift & Co., East St. Louis, Ill.			
	DRIED BLOOD.			
	Guarantee	13.65	16.58	......
1	Station No. 2268	13.71	16.64	......
	Virginia-Carolina Chemical Co., Memphis, Tenn.			
	KAINIT.			
	Guarantee	......	......	12.00
1	Station No. 399	......	......	12.05
	Planters Fertilizer Manufacturing Co., New Orleans, La.			
	DRIED BLOOD.			
	Guarantee	13.20	16.02	......
1	Station No. 3078	13.56	16.46	......
	Guarantee	13.20	16.02	......
1	Station No. 204	14.00	17.00	......
	Guarantee	13.20	16.02	......
1	Station No. 203	14.14	17.17	......
	KAINIT.			
	Guarantee	......	......	12.00
1	Station No. 3130	......	......	12.75
	MURIATE OF POTASH.			
	Guarantee	......	......	50.00
3	Average of 3 analyses	......	......	50.53
	Maximum	......	......	52.30
	Minimum	......	......	48.76
	Two samples below guarantee.			
	New Orleans Acid and Fertilizer Co., Gretna, La.			
	DRIED BLOOD.			
	Guarantee	13.18	16.00	......
1	Station No. 1881	13.53	16.43	......
	KAINIT.			
	Guarantee	......	......	12.00
10	Average of 10 analyses	......	......	12.75
	Maximum	......	......	13.07
	Minimum	......	......	12.21
	All samples up to guarantee.			

Number of Analyses......	NAME OF MANUFACTURER AND BRAND.	Nitrogen.......	Ammonia	Potash.........
	MURIATE OF POTASH.			
	Guarantee	......	......	50.00
3	Average of 3 analyses	......	......	51.71
	Maximum	......	......	52.59
	Minimum	......	......	51.20
	All samples up to guarantee.			
	NITRATE OF SODA.			
	Guarantee	15.00	18.21	......
1	Station No. 290	15.94	19.35	......

PARIS GREEN

is largely used in this State as an insecticide, chiefly for the destruction of the cotton caterpillar, whose ravages are frequently so injurious. This chemical consists chiefly of the "Arsenite of Copper," with a small proportion of the Acetate of Copper, and a first-class article should contain not less than 50 per cent. of arsenious acid, known in its pure state as white arsenic.

This article is frequently adulterated, and there are abundant opportunities for fraud in its purchase. Farmers and planters frequently complain of the ineffectiveness of Paris Green after use on their cotton; but they failed to take samples in accordance with the above law, and therefore have no means of definitely determining whether fraud has been practiced.

Many farmers and planters in Central Louisiana have made report of the ineffectiveness of the paris green used on their cotton during the present season. This is reported after a failure, but they failed to take samples in accordance with the above law, and therefore had no means of ascertaining positively whether fraud had been perpetrated.

The law fully protects every farmer if he will observe it. Before buying, inspect packages and see that "Strictly Pure" and "Guaranteed," with the fac-simile of the signature of the Commissioner of Agriculture and Immigration, are stamped on each. If they are, take a sample in accordance with directions of the law, and if after using little or no benefit accrue, have it analyzed by the official chemist, and, if deficient, damages can be recovered. The following samples have been analyzed:

Number of Analyses....	NAME OF MANUFACTURER OR SELLER.	Arsenious Acid
	I. L. Lyons & Co., New Orleans, La.	
	Guarantee	50.00
35	Average of 35 analyses	52.49
	All samples up to guarantee.	
	Vermont Chemical Mfg. Co., New Orleans, La.	
1	Station No. 22	57.61
	L. N. Brunswig & Co., New Orleans, La.	
2	Average of 2 analyses	54.35
	Parker, Blake & Co., New Orleans, La.	
1	Station No. 39	54.81
	Finlay, Dicks & Co., New Orleans, La.	
1	Station No. 40	54.94
	Adler Color and Chemical Co., New York, N. Y.	
24	Average of 24 analyses	55.44
	All samples up to guarantee.	
	L. R. Berger & Co., New York, N. Y.	
5	Average of 5 analyses	56.32
	All samples up to guarantee.	
	Acme Color Works, New York, N. Y.	
2	Average of 2 analyses	58.08
	Fred L. Lowenberg, New York, N. Y.	
2	Average of 2 analyses	56.32
	A. B. Ansbacker & Co., New York, N. Y.	
10	Average of 10 analyses	56.19
	All samples up to guarantee.	

REPORT

Covering Seventeen Years of Work of the

INSPECTION OF COMMERCIAL FERTILIZERS

under the supervision of the

LOUISIANA STATE BOARD
OF
AGRICULTURE AND IMMIGRATION.

FROM 1886 TO 1903.

By Chas. H. O'Rouke, Chief Inspector of Fertilizers.

ANNUAL REPORT

OF THE

FERTILIZER INSPECTION DEPARTMENT

OF THE

State Board of Agriculture and Immigration of Louisiana

For the Season 1902-3.

J. G. LEE, Commissioner.
N. S. DOUGHERTY, Secretary.
CHAS. H. O'ROUKE, Chief Fertilizer Inspector.

LOUISIANA STATE BOARD
OF
AGRICULTURE AND IMMIGRATION

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N. S. Dougherty, Secretary, Baton Rouge.

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FERTILIZER INSPECTION DEPARTMENT.

BATON ROUGE DISTRICT—
Millard S. Perkins, Inspector, Baton Rouge, La.
CALHOUN DISTRICT—
N. E. Calhoun, Inspector, Colhoun, La.
LEESVILLE DISTRICT—
E. T. Sellers, Inspector, Alexandria, La.
TERREBONE DISTRICT—
J. C. Murphy, Inspector, Murphy P. O., La.
NEW ORLEANS DISTRICT—
Main Office Fertilizer Inspection Department;
Chas. A. O'Rourke, Inspector, 714 Union St. New Orleans.

SUB-INSPECTION DEPARTMENT.

BATON ROUGE DISTRICT.

Irvin Maginnis	Alexandria, La.
H. R. Bell	Alexandria, La.
D. I Muldoon	Alexandria, La.
Henry Frith	Bunkie, La.
J. L. Mornhinveg	Opelousas, La.

CALHOUN DISTRICT.

J. J. Richards	Lake End, La.
A. A. LeRosen	Shreveport, La.
J. E. Ransom	Monroe, La.
A. B. Cudd	Minden, La.
Elmo Colvin	Ruston, La.
Thos. H. Brown	Homer, La.
H. O. Scott	Vidalia, La.

TERREBONNE DISTRICT.

J. K. Milacon	Breaux Bridge, La.
A. A Morgan	Lafayette, La.
T. L. Broussard	St. Martinsville, La
S. J. Bonvillain	New Iberia, La

R CALHOUN DISTRICT, SEASON 1902-1903—N. E. CALHOUN, INSPECTOR, CALHOUN, LA.

Sub-inspection Department.																	Total Number of Tons Fertilizer for District Season 1902-1903.		
e Rosen, vesport, La		J. E. Ransom, Monroe, La.			A. I. Cudd, Minden, La.			Elmo Colvin. Ruston, La.			Thos H. Brown, Homer, La.			H. O. Scott, Vidalia, La.					
Number of Tons C. S. M. Fertilizer	Number of Sacks C. S. M. Fertilizer Shipped	Number of Inspections	Number of Tons C. S. M. Fertilizer Shipsed	Number of Sacks C. S. M. Fertilizer Shipped	Number of Inspections	Number of Tons C. S. M. Fertilizer Shipped	Number of Sacks C. S. M. Fertilizer Shipped	Number of Inspections	Number of Tons C. S. M. Fertilizer Shipped	Number of Sacks C. S. M. Fertilizer Shipped	Number of Inspections	Number of Tons C. S.M. Fertilizer Shipped	Number of Sacks C S M. Fertilizer Shipped	Number of Inspections	Number of Tons C. S. M. Fertilizer Shipped	Number of Sacks C. S. M. Fertilizer Shipped	Total Number of Inspections	Total Number of Tons Fertilizer Shipped	Total Number of Sacks Fertilizer Shipped
		2	75.	1500													2	75.	1500
		2	130.	2600										12	433.	8660	15	573.	11460
3.	60				5	24.	480				2	20.	400				115	1521.15	30443
6.65	133																7	69.25	1385
1.10	22																1	1.10	22
15.	300																1	15.	300
																	5	38.50	570
		3	83.50	1670							49	340.55	6811				114	1259.05	25181
39.55	791																6	39.55	791
		2	79.95	1599										1	100.	2000	4	204.35	4099
								1	14.30	286							15	189.90	3786
		6	294.50	5890										3	315.	6300	9	609.50	12190
2.	40	4	50.	1000				3	31.55	631							46	568.50	11370
																	6	63.75	1275
2.10	42																1	2.10	42
00.	6000	1	70.	1400													3	370.	7400
5.	100	29	908.30	18169				1	18.	360							49	1188.40	23768
		1	25.	500													1	25.	500
																	3	145.	2900
4.50	90																1	4.50	90
																	1	75.	1500
		4	205.	4100													4	205.00	4100
		1	10.	200													3	51.	1020
		9	25.15	501				1	10.	200							38	452.00	8906

.....	684.80	954.50	551.	911.50	226.70	1898.45	37959	30145	13247	....	16896	2676.15	51216
.....	....	117.	192.50	....	....	14.30	286	2250	3850	1600	....	206.80	4136
.....	400.	....	98.	400.	....	245.	4900	4800	1190	....	3610	343.	6090
.....	....	41.50	26.	....	....	....	....	830	520	....	310	26.	520
.....	475.35	177.	66.20	1796.	1320.65	3638.55	72771	25214	17772	....	7442	5025.40	90543
.....	....	676.23	692.45	....	....	83.55	1671	12105	13849	1744	....	776.	15520
.....	....	94.10	162.95	....	....	....	....	1781	2212	431	....	162.95	2212
.....	....	....	1.	....	....	.20	4	....	20	20	....	1.20	24
.....	....	110.25	61.90	....	....	63.75	1275	2205	1235	....	970	125.65	2510
.....	....	15.50	73.60	....	....	2.10	42	310	1471	1161	....	75.70	1513
.....	159.	69.87	56.65	159.	....	470.15	9403	2927	888	....	2039	526.80	10291
.....	....	913.50	1672.80	....	....	935.30	18706	18287	33676	15389	....	2608.10	52382
.....	712.99	295.80	350.75	1152.99	440.	332.65	6553	19627	12247	....	7380	1123.40	18800
.....	70.	2.60	.10	70.	....	55.	1100	746	1	....	745	55.10	1101
.....	25.	489.85	416.25	25.	....	315.40	6278	10080	8279	....	1807	731.65	14557
.....	....	45.	170.	....	....	147.	2940	900	3380	2480	....	317.	6320
.....	....	....	1.	....	....	....	....	....	10	10	....	1.	10
.....	....	95.85	209.75	....	....	4.50	90	1760	4195	2435	....	214.25	4285
.....	190.	....	184.	340.	150.	425.70	8514	4067	4447	410	....	759.70	12991
.....	141.	255.	....	651.	510.	460.	9200	12508	6113	....	6395	970.	15313
.....	....	....	120.40	....	....	....	....	....	2408	2408	....	120.40	2408
35.50	....	430.10	201.65	2143.50	2379.	1404.50	28085	39568	41188	1620	....	3985.15	69273
.....	575.	177.05	151.	630.	355.	829.50	16590	12238	7208	....	5030	1335.50	23798
.....	....	213.	156.25	....	....	12.	240	4260	3115	....	1145	168.25	3355
.....	20.	....	30.25	20.	....	150.	3000	240	605	365	....	180.25	3605
.....	465.09	672.30	1150.50	2174.49	1711.40	3329.75	66595	38697	43605	4908	....	6191.65	110200
.....	....	1341.05	1080.85	....	....	.65	13	17022	12094	....	4928	1081.50	12107
.....	....	3465.40	3989.65	....	....	375.	9500	60660	73891	13231	....	4364.65	83391
.....	....	73.60	.20	....	....	....	....	1472	2	....	1470	.20	2
36.06	....	702.30	672.	3523.49	3659.55	1259.	25180	55713	59425	3912	....	5590.55	84605
.....	....	315.25	661.50	....	....	3715.	741	6105	13070	6965	....	698.65	13811
65.	....	15.05	47.50	....	65.	30.	600	301	1729	1428	....	142.50	2329
.....	....	409.50	293.	....	....	9.	180	8173	5860	....	2313	302.	6040
.....	....	2666.10	3836.30	....	....	....	....	36996	57861	20865	....	3836.30	57861
.....	....	762	485.70	....	....	274.20	5484	15190	9715	....	5475	759.90	15199
.....	....	130.50	32.	....	....	1146.	21639	2610	640	....	1970	1178.	22279
.....	....	....	....	....	....	....	....	....	....	....	....	....	....
.....	....	187.	200.50	....	....	....	....	3440	3690	250	....	200.50	3690
.....	....	88.	139.	....	....	97.20	1944	1619	2780	1161	....	236.20	4724
.....	4931.63	....	....	18973.97	....	....	....	805976	....	....	128297	....	....
36.56	436.56	....	....	14478.90	14478.90	....	....	766521	766321	88842	88842	....	....
.....	4495.07	....	....	4495.07	....	....	....	39455	....	....	39455	....	....
.....	....	....	31230.60	....	....	....	444844	....	766321	....	....	....	1211165
.....	....	30230.45	30230.45	....	....	....	....	....	....	....	....	....	....
.....	....	....	1000.15	....	....	....	....	....	....	....	....	....	....
.....	....	....	31230.60	....	14478.90	22213.10	....	....	....	....	....	67922.60	....

Respectfully Submitted,

Chas. H. O'Rourke

Chief Inspector of Fertilizers and Paris Green.

Annual Statistical Table of Fertilizer Tonnage for Leesville District Comp from Individual Reports of Inspector E. T. Sellers, Alexandria, La.

PARISHES	Commercial Fertilizer			Cotton Seed Meal Fertilizer			Total Number of Tons Fertilizer for Leesville District. Season 1902-1903		
	Number of Inspections	Number of Tons Fertilizer Shipped	Number of Sacks Fertilizer Shipped	Number of Inspections	Number of Tons Fertilizer Shipped	Number of Sacks Fertilizer Shipped	Total Number of Inspections	Total Number of Tons Fertilizer Shipped	Total Number of Sacks Fertilizer Shipped
Calcassieu	15	258.50	4370	1	15.	300	16	273.50	4670
DeSoto	36	413.55	8271	....	....	.....	36	413.55	8271
Grant	6	75.	1500	....	....	.....	6	75.	1500
Rapides	9	157.	3140	....	....	.....	9	157.	3140
Red River	7	152.	3040	....	....	.....	7	152.	3040
Sabine	7	61.	1220	....	....	.....	7	61.	1220
Vernon	14	177.	3540	1	4.	80	15	181.	3620
Winn	4	50.	1000	....	....	.....	4	50.	1000
Total Number Commercial Fertilizer Tons	98	1344 05	26081	....	....	.....	..	....	......
Total Number C. S. M Fertilizer Tons	2	19.	380	2	19.	380	....	....	......
Toial Record for District, Season 1902-1903	100	1363.05	26461	....	....	.....	100	1363.05	26461

Main Office Fertilizer Inspection Department,
714 Union St., New Orleans. Nov. 21st 1903.

Respectfully Submitted.

Chas. H. O'Rourke

Chief Inspector of Fertilizer and Paris Green.

Main Office, Fertilizer Inspection Department,
714 Union St., New Orleans, Aug. 31, 1903.

Maj. J. G. Lee, Commissioner of Agriculture and Immigration,
Baton Rouge, La.:

Sir—I beg to hand you herewith final reports for the season 1902-1903, from Inspectors Calhoun, Murphy, Perkins, Sellers and report for your Inspection Department for the year with final report of New Orleans District, annual statistical tabulation of tonnages inspected in Calhoun, Baton Rouge, Leesville, Terrebonne and New Orleans Districts, with recapitulation tabulation of tonnages covering the work of inspection throughout the entire State; and a special report made in compliance with your request referring to the work of this department and the inspection of commercial fertilizers for the past seventeen years. Trusting all of them will meet with your approbation, respectfully submitted,

CHAS. H. O'ROURKE,
State Inspector Commercial Fertilizers and
Paris Green, New Orleans District.

Main Office, Fertilizer Inspection Department,
714 Union St., New Orleans, Aug. 31, 1903.

Maj. J. G. Lee, Commissioner of Agriculture and Immigration,
Baton Rouge, La.:

Sir—In submitting the documents referring to the work of this department for the season 1902-1903, beg to report that 4,061 inspections were made during the season, an increase of 1,173 inspections over season 1901-1902. This handsome increase in the number of inspections made was due by the operation of Act 48 of 1902, which makes cotton seed meal, when sold as fertilizer, amenable to Act 126 of 1898, as there were 892 inspections of cotton seed meal fertilizer during the season. Six hundred and seventy-one of these inspections were made by the sub-inspection departments of Calhoun, Baton Rouge and Terrebonne Districts, while Inspectors Perkins (112), Calhoun (11), Sellers (2), Murphy (33), O'Rourke (63) made the additional number of inspections of this commodity that go to make up the total of 892 inspections.

There were 67,922.60 tons (1,211,165 sacks) shipped. The commercial fertilizer tonnage (which includes all fertilizers, except straight cotton seed meal fertilizer and tankage) for the entire season amounted to 31,230.60 tons (573,729 sacks), an increase of 1,000.15 tons (16,477 sacks) over season 1901-1902. The tankage tonnage for the season 1902-1903 amounted to 14,478.90 tons (192,792 sacks), a decrease business of 4,495.07 tons (55,932 sacks) compared with last season. The cotton seed meal fertilizer tonnage for the season amounted to 22,213.10 tons (444,844 sacks), and this is the first year that this department has had supervision over this class of fertilizer. This cotton seed meal fertilizer tonnage has offset a decrease of 4,495.02 tons in tankage fertilizer tonnage for the season and effected a total increase business in fertilizer tonnage for the season 1902-1903, as compared with 1901-1902, amounting to 18,718.18 tons (405,189 sacks).

The commercial fertilizer tonnage (which term applies to all fertilizers, excepting straight cotton seed meal and tankage, sold for use in Louisiana) has been handled by your Inspection Department throughout the different districts, as follows:

	No. Inspections.	No. Tons.	No. Sacks.
BATON ROUGE DISTRICT,			
M. S. Perkins, Inspector....	62	1,630.50	31,380
CALHOUN DISTRICT,			
N. E. Calhoun, Inspector...	312	4,111.25	81,896
LEESVILLE DISTRICT,			
E. T. Sellers, Inspector.....	98	1,344.05	26,081
TERREBONNE DISTRICT,			
J. C. Murphy, Inspector....	2	12.50	247
NEW ORLEANS DISTRICT,			
C. H. O'Rourke, Inspector,	2,371	24,132.30	433,925
	2,845	31,230.60	573,529

The tankage tonnage (which term applies to the product of the packing houses of the West. For further description of this class of fertilizer see "State Chemist's Report" contained in this publication) has been handled by the Inspection Department throughout the cane growing sections of the State, as follows:

	No. Inspections.	No. Tons.	No. Sacks.
BATON ROUGE DISTRICT,			
M. S. Perkins, Inspector....	88	3,489.30	47,274
TERREBONNE DISTRICT,			
J. C. Murphy, Inspector....	187	6,656.60	82,649
NEW ORLEANS DISTRICT,			
C. H. O'Rourke, Inspector..	49	4,333	62,869
	324	14,478.90	192,792

The cotton seed meal fertilizer tonnage (which term applies to all shipments of straight cotton seed meal unmixed with any other fertilizer ingredients, made by oil mills and fertilizer factories, to points in Louisiana) has been handled by the Inspection Departments and their respective sub-inspection* departments, throughout the State, as follows:

	No. Inspections.	No. Tons.	No. Sacks.
BATON ROUGE DISTRICT,			
M. S. Perkins, Inspector....	112	2,703.30	52,773
By Sub-Inspectors	335	6,069.70	121,376
CALHOUN DISTRICT,			
N. E. Calhoun, Inspector....	11	228.25	4.565
By Sub-Inspectors	212	4,163.10	83,260
LEESVILLE DISTRICT,			
E. T. Sellers, Inspector.....	2	19	380
TERREBONNE DISTRICT,			
J. C. Murphy, Inspector....	33	1,980	39,600
By Sub-Inspectors	124	3,715.25	74,305
NEW ORLEANS DISTRICT,			
C. H. O'Rourke, Inspector..	63	3,334.50	68,585
	892	22,213.10	444,844

Recapitulated, the work of the Fertilizer Inspection Department for the season 1902-1903, irrespective of fertilizer classification, or the work of the sub-inspectors, has been as follows:

	No. Inspections.	No. Tons.	No. Sacks.
Baton Rouge District	597	13,892.80	252,803
Calhoun District	535	8,502.60	168,721
Leesville District	100	1,363.05	26,461
Terrebonne District	346	12,364.35	196,801
New Orleans District	2,483	31,799.80	565,379
	4,061	67,922.60	1,211,165

* Sub inspection means resident inspection of cotton seed meal, when sold as a fertilizer.

Letters from each inspector are presented herewith and your attention is respectfully referred to each. The system has now reached a most complete state and there are but few improvements that might be made. These are telephone facilities for the Calhoun. Terrebonne and New Orleans inspectors, and I hereby recommend the installation of telephones in these districts at the office of each inspector, if the service might be obtained at a reasonable cost. On October 19, 1903, a letter was addressed to Superintendent E. L. Powell of the Cumberland Telephone and Telegraph Company, this city, requesting information as to cost of long distance telephone service for use at Calhoun, Ouachita parish, La., Inspector J. C. Murphy's residence, near Murphy Postoffice, Iberia parish, and one for this office, 714 Union street, New Orleans. Superintendent Powell's reply to this request was to the effect that it would be necessary to contract for one year at the rate of five dollars ($5.00) per month, for the use of a long distance telephone connected with the company's telephone exchange at Monroe, La., for the service in Calhoun District. In reference to the telephone at Inspector Murphy's residence, Superintendent Powell stated in his letter of October 23, 1903, that about fifty poles were necessary for the establishment of this connecting line with Jeanerette exchange and that it would be necessary for this department to pay $1.30 for each pole besides entering into a contract for one year at the rental rate of five dollars ($5.00) per month. For this office the company would be perfectly willing to install a long distance 'phone "on direct line for the city connections" at the rate of ten dollars and fiffity cents ($10.50) per month, and offer a discount of fifty cents per month if the quarterly sum of $31.50 be paid in advance. These propositions involve sums of money that are inconsistent with our needs and unless more reasonable rates are obtained telephone service for Terrebonne and Calhoun Districts are prohibitive at the charges the Cumberland Telephone and Telegraph Company quote. I understand that there is a case now pending before the Railroad Commission of Louisiana, instituted by Messrs. LeBlanc & Danos against the Cumberland Telephone and Telegraph Company which involves the question of charges for country telephone service, that will be decided by the State Railroad Commission December 15. Therefore, I suggest that this mattter of telephone service for Calhoun and Terrebonne Districts be held in abeyance until above mentioned case is decided. In regard to the New Orleans office 'phone, will endeavor to obtain rates for a limited service 'phone and will submit the same to you for your approval before contracting for a telephone for this office.

I would also suggest that some arrangements be made for the inspection of Shreveport fertilizer at the factory so as to avoid the extra expense of traveling to inspect shipments at destination, when arrangements could easily be made to handle the business at the starting point. Eighty per cent. of the inspections made in Leesville District for the past season were of Shreveport fertilizer, and the expense of handling the business after this manner is impracticable and too expensive. In dealing with the subject of Shreveport fertilizer inspections in Annual Report for the Season 1901-1902, dated July 17, 1902, at Calhoun, La., (a copy of which appears in Fertilizer Bulletin No. 73), Inspector Calhoun presented this matter as follows: "During a short time my work was so badly scattered and came in such a rush that it was impossible for me to reach all goods shipped before they were sold out. I wrote the department and was relieved by being allowed an assistant for a short while. Now, I think possibly this can be remedied by having, or allowing me to do, at least the most of my inspecting of goods made at Shreveport, Minden and Ruston, at the factories. I have visited the factories frequently the past season and I find that they run possibly for two days in the week and then ship out from these until it is exhausted, especially so with their cotton and corn mixtures."

Your attention is also invited to paragraph four of my annual report for the season 1901-1902 appearing in same publication

(Fertilizer Buletin No. 73), which reads as follows: "I respectfully call your attention to that part of the inspector's letter from Calhoun District in which Inspector Calhoun refers to local inspections. I would recommend that discretionary powers be allowed him in regard to inspections of cotton and corn mixtures of the Shreveport, Minden and Ruston factories, at the same time adhering to the established rule of this department relative to the inspection of all fertilizer mixtures marketed in this State. All fertilizer plants prepare for the busy season ahead of time by mixing their most popular brands in large quantities at one time. Inspector Calhoun can easily avoid error by sampling large lots and keeping account of number of sacks in pile by previously arranging with shipper to this effect. All the records of shipments made from his territory, passing through his hands, he can easily arrange to control this feature of the proposition."

In the presentation of these references would state that the commercial fertilizer business of Leesville District does not assume proportions that justify the employment of an inspector for that territory, alone, and I respectfully recommend that different arrangements be made for that district for the season 1903-1904.

In regard to the New Orleans District, beg to state that the work has now reached a point where it is impossible for one man to perform the duties of the office without assistance. The tonnage for the New Orleans District has increased from 8,906 tons for the season 1899-1900 to 31,799 tons for the season 1902-1903. The growth of this tonnage alone would more than justify this request for assistance—the first I have made—but coupled with the addition of other work arising from the inspection of cotton seed meal fertilizer, the establishment of a more complete system for the recording and control of each tankage shipment has brought about a very large increase of work. This matter is most important and the need of service is immediate. The work to be done at the present time is more than I can perform, so I trust you will give this subject your prompt attention.

Several shipments were seized during the early part of the season, in New Orleans District, as a result of the cotton seed meal coming under the operation of Act 126 of 1898. The outlook for a favorable year for the season 1903-1904 is very fair and there is every reason to expect a harmonious business void of the many disagreeable features that arose during the past season as a result of the establishment of this new cotton seed meal fertilizer law. Two shipments of commercial fertilizers made by the Virginia-Carolina Chemical Company to points in Tangipahoa parish were seized as the shipments were made without department tags attached, in violation of law. These consignments were made in violation of law, through clerical error, I feel sure, and upon presentation of these facts to you, the shipments were ordered released upon payment of all costs arising from seizures by the shippers, which they paid. Fines were not exacted in these two cases.

In reference to certain shipments of fertilizers made by manufacturers, classified as "Special Brands," "Special Formulas," etc., I would invite your attention to the fact that such shipments are generally made without any guarantee being given to the consignment, or, if so, without evidence of the same upon the sacks. This method attracted my attention when I first assumed the duties of this office, but I have refrained from approaching the matter in public report, fearing to infringe upon the rights of the State chemist. These formulas assume the character of special orders from consumers to the manufacturers for certain grades of mixed ingredients and, in my opinion, the mixture should be guaranteed by the manufacturer. The law does not specify or allow the shipping of any fertilizer without guarantee and I respectfully recommend that all manufacturers and dealers doing business in commercial fertilizers in Louisiana be required to guarantee every shipment they make for use in this State.

Another feature in the business of fertilizer commerce in Louisiana, and like conditions prevail in a few other States, is the broad allowance to manufacturers in guaranteeing the minimum and maximum guarantees of chemical contents in fertilizer. In some instances the guarantees of one ingredient ranges from one to five per cent. It would seem more consistent with accuracy to require the manufacturers to show only the minimum, or actual amount of an ingredient guaranteed. This position has been taken by several States having a similar law to our own. These varying guarantees cause no little confusion in the minds of many farmers, and to most, leads them into mistaken ideas as to the value of the fertilizer. It is very seldom a mixed fertilizer exceeds the minimum guaranteed, while the maximum is not often attained. This method of guaranteeing is misleading to the purchaser. Leaving the consideration of transaction between buyer and seller out of the question, there is a percentage allowed by the present plan of guaranteeing the chemical content of commercial fertilizers in this State that misleads the farmer insofar as to what he might expect and what he generally gets. Therefore, I respectfully suggest that the department rule on this important subject, that all dealers and manufacturers in commercial fertilizers doing business in Louisiana be required to guarantee only the minimum or actual amount of fertilizing ingredients contained in the product of their manufacture and that the custom of manufacturers placing a minimum and also a maximum guarantee upon specified chemical properties in fertilizer be discontinued, and only the minimum guarantee of a named ingredient and no mention of its equivalent be allowed. According to Hon. R. E. Rose, State chemist, Agricultural Department, State of Florida, whose statement in annual report for 1902, I have the honor to quote: "This position is also assumed by the Association of Official Agricultural Chemists and the Association of American Agricultural Colleges."

In concluding this report, I desire to thank every one connected with the Inspection Department for their prompt and efficient work, also the State Chemist Department likewise. To all the farmers and planters and plantation managers whom it has been our pleasure to serve, to the railroad and steamboat agents, manufacturers and dealers in fertilizers, I desire to extend the thanks of this department for their co-operation in the work. The season has been a most prosperous one, though the hardest this department has ever had. We have performed a work of which we might truly be proud, and with this feeling these reports are submitted to you with the hope that they wil meet a like spirit resulting in your approbation of them. Respectfully submitted,

CHAS. H. O'ROURKE,
State Inspector of Commercial Fertilizers and
Paris Green, New Orleans District.

Baton Rouge, La., August 31, 1903.

Mr. Chas. H. O'Rourke, State Inspector of Fertilizer, 714 Union Street, New Orleans:

Dear Sir—In compliance with your letter of recent date, beg to submit my final report for the season of 1902-1903. As compared with the work of last season the tonnage for Baton Rouge District shows an increase of 420 inspections, 6,765.30 tons, 137,230 sacks. The business for the season 1902-1903 amounted to 597 inspections, 13,892.80 tons, 252,803 sacks. This large increase of business has been partly handled by the Sub-Inspection Department of this district, established to control the inspection of cotton seed meal fertilizer at the commencement of this season. The business in this department has been handled as follows:

	No. Inspections.	No. Tons.	No. Sacks.
Mr. Irvin Maginnis, Alexandria, La.,	37	431.05	8,613
Mr. H. R. Bell, Alexandria, La....	60	284.60	5,682
Mr. D. I. Muldoon, Alexandria, La..	72	1,180.30	23,606
Mr. Henry Frith, Bunkie, La......	81	2,165.25	43,305
Mr. J. L. Mornhinveg, Opelousas, La.,	85	2,008.50	40,170
	335	6.069.70	121,376

My duties for this season have comprised inspection of 7,823.10 tons, 131,427 sacks of fertilizers covered by 252 reports made at the time of each inspection. This is an increase of 85 inspections, 695.60 tons, 15,854 sacks, for my individual field operations this season as compared with last.

The addition of cotton seed meal to the list of fertilizers amenable to the State fertilizer law has been the means of increasing to no small extent the work in this district. The management of the Sub-Inspection Department has required much time and attention, though my remarks in this respect must be in no wise taken to mean inefficiency on the part of the sub-inspectors for Baton Rouge District. Each one has contributed his share to the exceptionally fine showing made in this district this season and I desire to thank each and every one, in public report, for the able manner and prompt execution in the fulfillment of their duties which have been shown. At the commencement of the season some difficulties were met with that seemed forerunners of a very unpleasant season in regard to the establishment and maintenance of the cotton seed meal fertilizer law, but in the few cases I refer to the shippers, upon notification of the technical non-compliance with certain requirements of the cotton seed meal fertilizer law showed every desire to comply with the same and I am glad to state that there is not an oil mill in operation in this district that has not qualified to do business according to the State fertilizer law, and there is every reason to look forward to a harmonious season, in this respect, for 1903-1904.

The sample express case feature has proven advantageous and has been very convenient. The system at the present time is complete and I know of no additions that might be made in the way of new features that would increase its efficiency. However, in regard to the tankage business, some arrangements should be made whereby the shippers would arrange for a more complete notification of diverted shipments.

The field work for this season, especially during the spring, was much retarded by the inclement weather, as also by the high stage of the Mississippi river, and the shipments of fertilizers have shown a decrease this season as a result of this, and also the crevasse on Bayou Lafourche, to what it is reasonable to suppose they would have been, judging from the number of orders countermanded.

In concluding my report, I desire to thank you for the assistance you have given, as also the planters and their plantation managers for the many courtesies and co-operation they have extended to me in this work, and with assurance of sincere desire to promote to the highest point of efficiency the good work to be accomplished in the future, I remain, very truly yours,

MILLARD S. PERKINS,
State Inspector of Fertilizers, Baton Rouge District.

Calhoun, La., September 1, 1903.

Mr. Chas. H. O'Rourke, State Inspector of Fertilizer, 714 Union Street, New Orleans:

My Dear Sir—As per your request, I beg herewith to submit my final report for season 1902-1903. During this season 535 inspections have been made in Calhoun District, amounting to 8,502.60 tons, 169,721 sacks, showing an increased business this year over last amounting to 210 inspections, 3,721.62 tons, 75,837 sacks.

The increase of work has been handled by the sub-inspectors as follows:

	No. Inspections.	No. Tons.	No. Sacks.
J. J. Richards, Lake End, La......	3	145	2,900
A. A. LeRosen, Shreveport, La....	19	390.10	7,802
J. E. Ransom, Monroe, La.........	64	1,956.40	39,126
A. B. Cudd, Minden, La...........	47	295.70	5,914
Elmo Colvin, Ruston, La.........	12	167.35	3,347
Thos. H. Brown, Homer, La......	51	360.55	7,211
H. O. Scott, Vidalia, La..........	16	848	16,960
	212	4,163.10	83,260

The total tonnage for Calhoun District for the season 1901-1902 was 325 inspections, 4,780.98 tons, 93,884 sacks, showing some decrease in tonnage this season. This has been caused by a portion of my territory being cut off and given to Leesville District, also by the excessive rains, high water and bad roads just at the season when all farmers buy the bulk of their fertilizer, causing many to cut short their usual supply. I feel that my territory really made an increase in commercial fertilizers, leaving off the work done by the sub-inspectors of cotton seed meal. Then, too, Sub-Inspector Thos. H. Brown, at Homer, La., inspected the mixture put up by the Homer Cotton Oil Company and it is credited as cotton seed meal. In the early part of the season I found several cotton oil mills a little inclined to rebel at the idea of having their goods inspected, but later on all fell in line, that is, all that shipped out cotton seed meal as fertilizer. I believe that all the mills in this district qualified except the Hamilton Oil Mill, of Shreveport. They did not offer cotton seed meal as fertilizer. I find nearly all the mills ready to assist or do anything to facilitate our work, yet an occasional kicker. We were a little late in getting the cotton seed meal fertilizer business in shape, but it is now very well organized and I am sure can do most satisfactory work another season. In a few instances I have found the fertilizers shipped into this territory by certain manufacturers who have failed to notify this office of the shipments. The Jackson Fertilizer Company, of Jackson, Miss., always mail their notices for this district to Baton Rouge, which often causes an extra trip and extra expense to reach goods shipped. I find that the consumers are well pleased with the inspecting of cotton seed meal as fertilizer. I feel under many obligations to the trainmen of the V., S. & P. railroad for favors shown me during the past season. Now, as to the advisability of putting in a telephone, I believe it would greatly facilitate the work, oftentimes it would save the expense of going to a place to inspect goods before the arrival of same, which often occurs. Besides it would put me in direct communication with New Orleans and Baton Rouge offices. I have investigated and find that we can get a telephone put in here at my office for five dollars ($5.00) per month, connected with the Monroe exchange, but think possibly the department could arrange with the Cumperland Company to connect with all points from Monroe to Shreveport at same price. Thanking you for your hearty co-operation and pledging my every effort to obtain the most perfect system of operation in this work, I am, with high regards and very best wishes, cordially yours,

N. E. CALHOUN,
State Inspector of Fertilizers, Calhoun District.

Alexandria, La., August 25, 1903.

Mr. Chas. H. O'Rourke, State Inspector of Fertilizer, 714 Union Street, New Orleans:

Dear Sir—I herewith hand you my report of fertilizers inspected in the Leesville District from February to June of this year. There have been one hundred inspections made, representing 1,363 tons distributed, as follows:

Calcasieu	273.50
DeSoto	413.55
Grant	75
Rapides	157
Red River	152
Sabine	61
Vernon	181
Winn	50
Total number of tons	1,363.05

I feel sure that a much larger amount would have been used by the farmers but for the incessant rainfall which made the roads impassable, thereby preventing them from transporting their fertilizer to the farms. My relations with the purchasers of fertilizers have been exceedingly pleasant; every one of whom seemed to take a pleasure in showing me his goods and rendering me every assistance in their power, and seemed anxious to comply with every requirement of the law. In a few instances I have heard of shipments made in violation of law, but upon investigation in each case have found the shippers ever ready to comply with the law. I do not believe there has been a single willful attempt to violate the law. Thanking you and all connected with the department for the nice treatment I have received, I am, very respectfully,

E. T. SELLERS,
State Inspector of Fertilizers, Leesville District.

Murphy P. O., La., August 24, 1903.

Mr. Chas. H. O'Rourke, State Inspector of Fertilizer, 714 Union Street, New Orleans:

My Dear Sir—Yours of the 20th to hand. There were 346 inspections made in this, the Terrebonne District, season 1902-1903. Cotton seed meal fertilizer inspections made by sub-inspectors were as follows:

	No. Inspections.	No. Tons.	No. Sacks.
J. K. Milancon, Breaux Bridge, La.,	33	759	15,180
A. A. Morgan, Lafayette, La......	17	527	10,540
T. L. Broussard, St. Martinsville, La.	27	1,250	25,000
S. J. Bonvillain, New Iberia, La....	47	1,179.25	23,585
	124	3,715.25	74,305
I made the following inspections..	222	8,649.10	122,496
	346	12,364.35	196,801

I think proper to call your attention to the fact that there is much confusion caused by the diversion of cars from one place to another without proper notice to the inspector, and another mode of handling tankage causes a great deal of confusion and some little time and trouble. It is the transferring of tankage from cars while in transit.

It was my unpleasant duty to cause to be seized four cars of tankage for not being properly tagged, as the law directs. One car of "Shrimp Hulls," consigned to Barrow & Duplantis, from the Barataria Canning Company, of Biloxi, Miss.; one car of tankage from the Crescent City Stock Yards and Slaughter House Company, Ltd., of New Orleans, La., consigned to Messrs. Barrow & Duplantes; two cars from Crescent City Stockyards and Slaughter House Company, Ltd., of New Orleans, La., consigned to Mr. L. F. Suthon, Honduras plantation. As soon as seizure was made and shippers notified of fact they came forward and tagged the goods. All costs were paid by them to Maj. J. G. Lee, commissioner, and goods were released and inspected according to instructions from Maj. J. G. Lee, commissioner. Mr. Bentz, representing the Barataria Canning Company, called on me, pleading ignorance of the law in regard to tagging goods, and was willing to fulfill all legal requirements, which he did at once. Much has been done to facilitate the work of the inspectors by furnishing them with proper expense bill forms, report blanks, etc. The sample cases are a great saving of time and expense and very convenient. Yet the work is increasing all the time on the inspectors. The office work is getting to be quite heavy where one is required to keep up correspondence with department headquarters at Baton Rouge, the main office in New Orleans, make out reports, keep day book and correspond also with sub-inspectors and the planters when they get rushed. A telephone would assist very materially and I think curtail the cost considerably in the inspector's office. Hope you will urge the putting in of 'phone. Yours very truly,

J. C. MURPHY,
State Inspector of Fertilizers, Terrebonne District

Maj. J. G. Lee, Commissioner of Agriculture and Immigration,
Baton Rouge, La.:

Sir—In compliance with your wishes in regards to a report from this office covering the work of the inspection of commercial fertilizers under the supervision of the State commissioner of agriculture, from the passage of the first law enacted in Louisiana regulating the manufacture and sale of commercial fertilizers in this State, up to the present time, beg to hand you my report. In the compilation of these facts and the formation of a report covering records for seventeen years, and the gathering and concentration of data scattered through the pages of seven biennial and three annual reports of six commissioners of agriculture; and owing to the vagueness of reference in a number of these reports to this important branch of the service, the scarcity of time for further research and the lacking of necessary data, I trust you will accept the good intention of my effort as genuine where seeming lacking as to detail in this report would otherwise tend to indicate a lukewarm effort.

The first official reference of the State commissioner of agriculture to a fertilizer law for Louisiana is to be found in recommendations of Commissioner Thompson J. Bird, in Biennial Report of Commissioner of Agriculture, to his excellency, Samuel Douglas McEnery, issued in April, 1886, an abstract from which is as follows: "Your attention is also specially called to the complaint of inferior fertilizers, sold in our market, made by some of our most intelligent correspondents. The sale of inferior fertilizers is an imposition upon our planters and farmers. It begets distrust in their efficiency and prevents their universal use. It is now well known that when properly compounded articles are intelligently used they pay a handsome profit upon investment.

"But, unfortunately, no planter or farmer before trial can tell a good article from a spurious one. They look alike, they smell alike, they feel alike, and the most careful and experienced planter is as often the victim of this fraud as the careless and inexperienced. Hence, the necessity of some law looking to the protection of the farmer in the purchase of commercial fertilizers. Every State north of us, without exception, has laws regulating the sale of fertilizers. These laws have for their object either an inspection before sale, with prohibition of the worthless, or a guarantee with the sale of its genuineness, and a means by which the guarantee may be enforced. Wherever these laws have been adopted cheaper and better goods have been offered on the market, confidence has been established, sales have increased and, better than all, a continuous increase of knowledge on the part of the farmer as to what constitutes a good fertilizer, the adaptability of the different crops, and his increased vigilance in securing such. Especially does Louisiana need the protection of such a law; the Atlantic States north of her have, by their laws, driven adulterated and low grade fertilizers beyond their borders. She now offers a market to such goods without let or hindrance, and to protect herself against the 'refused goods' of other States, is now not only a 'consummation devoutly to be wished,' but a necessity which cannot be postponed. In most of the States a tax of fifty cents per ton, paid to the Department of Agriculture, which issues therefor tags enough to 'tag' a ton, is required of each manufacturer or dealer before he can sell any of his wares. By this means, too, a considerable income is derived, which in nearly every State is used exclusively for agricultural purposes. In Alabama two State experiment stations are handsomely maintained by the income from the tax. In Georgia, last year, over 180,000 tons of fertilizers were sold, yielding an income of $90,000. We urgently recommend that a tax of fifty cents per ton be placed upon fertilizers, by which means a revenue may be derived that in time will entirely support the department, and, in addition, create a surplus that we would recommend to be equally divided between the sugar experiment station near New Orleans, and the State experiment station at Baton Rouge, or so much thereof as the board of agriculture may deem necessary. With the tax, of course, goes protection to the farmer by the addition of either inspection or guarantee laws, as your legislature may adopt. With such protection we can hope for an extended use of fertilizers, and better and more profitable crops. Trusting that our efforts will meet the approbation of your excellency and the members of the general assembly, the foregoing is respectfully submittted. T. J. Bird, Commissioner of Agriculture."

As a result of this recommendation, in the legislative session of 1886 an act was introduced and became a law, known to the statutes as Act 51 of 1886. Thus the first legal requirement governing the manufacture and sale of commercial fertilizers in Louisiana was established and on and after the first day of January, 1887, the supervision of and inspection of all commercial fertilizers sold for use in this State was entrusted to the bureau of agriculture. Sections 8 and 9 of Act 51 of 1886, referring to the meth-

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ods to be followed out in the inspection of fertilizers, gives strength and meaning to the final sentence of Section 1, which reads:

"The said bureau, in addition to the power conferred on it by law, shall have power to make and establish rules to carry out the designs and purposes of this Act, and in conformity thereto."

Section 8. "Be it further enacted, etc., That the commissioner of agriculture may obtain, or cause to be obtained, at his discretion, fair samples of all fertilizers sold or offered for sale in this State, from manufacturers or dealers, and shall have them analyzed by the official chemist, and shall publish the analysis for the information of the public."

Section 9. "Be it further enacted, etc., That it shall be the duty of every person who sells a lot or package of commercial fertilizer, upon the request of the purchaser, to draw from same, and in the presence of the purchaser or his agent, a fair and correct sample in such a manner as the commissioner of agriculture may, by regulation, establish."

This presentation of Sections 8 and 9 is made to somewhat explain the lack of reference in detail, in subsequent biennial reports of commissioners of agriculture, and to establish, at the beginning, the discretionary powers in regard to the inspection of commercial fertilizers, vested in the bureau of agriculture by the wording of Sections 8 and 9, of Act 51 of 1886, approved July 3, 1886, and effective "on and after the first day of January, 1887."

The next official reference to the fertilizer law is to be found in Commissioner Thompson J. Bird's biennial report of 1888 (pages 4 and 5). A little more than one year had elapsed previous to this reference, since the operation of the law commenced, and from Commissioner Bird's reference in his first biennial report, after the passage of the law, it is evident that the first system of collecting commercial fertilizer samples from shipments made to points in Louisiana were obtained by the purchasers, a method legalized by Section 9 of the law.

For the year 1889-1890 the progress of the work is shown by a paragraph in Commissioner Bird's biennial report for these years, addressed to his excellency, Francis T. Nicholls, governor of Louisiana, under the heading, "The Fertilizer Law," on page 2, and is as follows:

"The act regulating the sale of commercial fertilizers in this

State, passed in 1886, has been in successful operation ever since. It has received the cordial approval and support of our farmers and planters, and has been generally complied with by the dealers and manufacturers of these wares. By its operation spurious goods have been driven from our midst and now only first-class articles find sale in the State. Our planters and farmers have learned, too, to implicitly rely upon good fertilizers for handsome returns, when intelligently applied. Again it has been beneficial in educating our farmers to a discrimination in the selection of fertilizers. A little experience soon teaches them that partial manures may frequently supplant complete ones, with profit. The income from the sale of tags has been gradually increasing, and the surplus, after defraying expenses incident to the execution of the law, has been used exclusively for the conduct of the experiment stations."

And then there is to be found the fourth official reference to the fertilizer law, that forewarned the results which ultimately arose from the many weaknesses of the law, as originally framed. To present the matter of conditions in a thorough light, paragraph under the head, "The Fertilizer Law," and the only reference to Act 51 of 1886 that treats upon the subject in Commissioner T. S. Adams' biennial report, April, 1892, is given herewith:

"The act regulating the sale of commercial fertilizer in this State, passed in 1886, has been in operation since that date. It has received the cordial support of many of our farmers and planters and has been complied with by most of the dealers and manufacturers who sell in this State. Some few foreign manufacturers, it is believed, have sold goods through their local agents without complying with the law. Facts have been obtained which will enable us, we think, to bring the local agents before our courts for violation of this law, and the bureau will use every effort to secure their punishment.

"The income from the sale of tags has not been as large as last year. This can be accounted for in two ways: first, the low price of cotton has deterred the cotton planter from its use; second, the sales mentioned above without the payment of the required fees."

Biennial report of Commissioner H. C. Newsom, addressed to his excellency, Murphy J. Foster, governor of Louisiana, in April, 1894, treats upon the subject of the operation of Act 51 of 1886, as follows: "The act regulating the sale of commercial fertilizers in this State, passed in 1886, has been in operation since that date. It has received the cordial support of nearly all the planters, and has been complied with by most of the dealers and manufacturers who sell in this State. Several agents and dealers have not complied with the law, and the State has promptly prosecuted them, both in the civil and criminal courts. Appeal has been made in one case to the United States Court, and your bureau has been served with an injunction restraining them from executing the law in this case until a decision upon the merits of suit is rendered. A prosecution in the Criminal Court of the State continues, with a verdict expected daily. I most earnestly recommend that the law be amended so as to avoid the question of "interstate commerce" and force all dealers who fail to comply with it to assume all risks of collection and be responsible for all damages arising from the use of fertilizers not guaranteed according to law. By this amendment few sellers would be willing to incur the personal guarantee of crop results, the only way by which the purity of goods could be estimated, and should such results be naught, a recovery, before the courts, of price paid, together with damages for the difference between what was obtained and what was reasonably to be expected. A decision, recently rendered by the Court of Appeals in the Fourth Circuit, was based upon such reasoning."

Thus, after these changes had been made to rectify and overcome the weak features of Act 51 of 1886, the establishment of a more complete fertilizer law was accomplished in the general assembly of 1894, during the second year of Governor Foster's administration, this revised law identified on the statutes as Act 72 of 1894; and in the Sixth Biennial Report of the Bureau of Agriculture, by Commissioner A. V. Carter, dated April, 1896, this reference to the fertilizer law, upon page eight, under usual heading, "The Fertilizer Law," is to be found: "The Bureau of Agriculture, in calling attention of farmers and planters of the State to Act 72 of 1894, would state that up to 1886 the grade of commercial fertilizers sold in the State was so low and spurious that it was necessary to pass a law for the protection of those using the same. After the passage of the law in 1886 the grade of fertilizers changed to a higher quality and at once came into general use. But the law of 1886 was found inadequate, and the law of 1894 has given more satisfaction and better protection to farmers and planters. The general use of fertilizers has increased the production and, of course, the profit in farming to that extent. This law has been appreciated and respected by the great majority of farmers and by almost all manufacturers. The enforcement of this was made obligatory on the commissioner of agriculture, and I desire and ask all farmers and planters to aid and assist me by refusing to receive the same unless bearing the commissioner's tag, and promptly notify me of all violations of law. By rendering this assistance the grade of fertilizers will be kept up and the sale of same be increased. All fertilizers sold without being duly tagged are considered fraudulent fertilizers, and the price for same cannot be collected by law."

So far as I glean from the document, this is the only reference made to the fertilizer law by Commissioner Carter in his biennial report of 1896, and as the report does not refer to inspection of fertilizers by representatives of the bureau, I infer that samples were still obtained by the purchasers.

To bring the matter of these facts to a better basis for understanding I desire to state that "Acts 41 and 56 of 1880, and re-enacted by, respectively, Acts 54 and 53 of 1884 identified the work of agriculture and the work of immigration separately, and that up to this time there existed a bureau of agriculture and a bureau of immigration, with a commissioner for each. Act 141 of 1894 establishes one bureau, etc., for both purposes, repeals all conflicting laws (Sec. 6) and imposes on the commissioner all the duties of the commissioner of agriculture and immigration, respectively." (See "Revised Laws of Louisiana," by Solomon Wolff, page 6.)

The supplementary to biennial report of Commissioner of Agriculture and Immigration J. G. Lee, dated May, 1898, to his excellency, Murphy J. Foster, governor of the State of Louisiana, which comprises a reference to department work in general from July, 1896, to May, 1898, has devoted to the question of fertilizer inspections remarks regarding the efforts made along this line, and the financial showing made, for the above mentioned period of time. Having already obtained the necessary data from the books of the department's office at Baton Rouge and from the State auditor's office, which will enable me to present this financial part of the seventeen years' records in regard to the operation of the fertilizer law in Louisiana since 1886, I will refrain from presenting here an abstract of that part of the supplemental report which treats the subject of finance, and will confine this reference entirely to that part of the report that refers to a reduction of the inspection fee that has been influential in bringing about a most favorable condition of affairs for this department. Up to the time of this supplemental report the residue of moneys remaining after the expenses of sustaining the inspection department had been met—an expenditure involving the costs of tags, printing, traveling expenses and clerk hire—went to the two experiment stations, Baton Rouge and New Orleans. In this supplemental report Commissioner Lee suggests that the fertilizer law (Act 72 of 1894) be so amended as to admit the North Louisiana Experiment Station to an equal share of this fund with the other stations. In commenting upon the operations and supervision of the fertilizer law, Commissioner Lee states: "The bureau has been active in its efforts to execute these laws. Two or more inspectors have been constantly in the field during the fertilizer season, and vigorous inspection has been pursued. Since the last report, and up to date, more than four hundred inspections of fertilizers have been made. Samples of each lot inspected were secured and analyses made and published in Bulletin No. 49, known as the 'Fertilizer Bulletin,' for the information of the public. Only two violators of the law were found.

Suit was at once instituted against them, and several cases are now pending in the State courts, the sums sued for in the several cases aggregating more than one-half million dollars." Continuing further, the report reads: "The complaint has been made by dealers and manufacturers in commercial fertilizers, and also by some purchasers of fertilizers, that the inspection tax of fifty cents per ton is too high; that it encourages sales without the tags; that a twenty-five cents per ton taggage would not be violated, and that the proceeds thus resulting would equal the proceeds arising from the fifty cents per ton taggage now charged. Since the object of the law is to protect farmers against fraud in fertilizers, it is evident that the smaller amount (twenty-five cents) will secure that protection just as the greater amount (fifty cents) now secures it. If that be true, and since the farmer himself finally pays the tax, why tax him the greater amount, when the smaller amount secures him the result sought? It is therefore suggested to your excellency that the law be also amended on this point."

And thus it came to pass that conditions had arisen to justify and require the third re-enactment of a law that means so much to Louisiana agriculture and legitimate business—the manufacture and sale of commercial fertilizers. The State Constitutional Convention of 1898 investing the powers and authorizing the supervision of maintaining effective control of the manufacture or sale, in this State, of fertilizers and paris green for the suppression of adulteration and fraud therein, with the Louisiana State Board of Agriculture and Immigration, presented in Article 306, have been perpetuated in regard to fertilizers by the enactment of Act 126 of 1898, drafted from Act 72 of 1894, with objectionable features of both the Act of 1894 and Act 51 of 1888 eliminated. This law reduced the inspection fee from fifty to twenty-five cents per ton, as a result of the recommendation of Commissioner Lee.

Annual Report dated March 20, 1899 (Vol. 8), by Commissioner J. G. Lee, upon his retirement from the commissionership of agriculture, comments most favorably upon the operation of Act 126 of 1898, and, after stating that a better system of organization had been established in the Inspection Department and the better results obtained under the revised law, Commissioner Lee refers to the financial outcome of the reduction of inspection fee from fifty to twenty-five cents. I would present this gratifying comparison of finance regarding revenues (page 3, paragraph 2): "Notwithstanding the taggage fee was reduced one-half, the amount arising from the sale of tags up to date has been $5,238.20. For the corresponding date of last year it was $5,065.95, thus showing an increase of $172.25 for the present year, and the late injury to the cane crop has materially reduced fertilizer sales."

In State Chemist's Report, of volume 9, (biennial report of 1899-1900) this reference is made to the fertilizer law (page 33, paragraph 3): "The fertilizer law has been most energetically executed this year. Nearly every lot, large or small, sold in the State, has been inspected, sampled and analyzed. In many instances planters and farmers have sought of their own accord inspection and withheld payment for the goods until guarantee was sustained by official analysis. Nearly one thousand samples have thus been obtained. The law is growing in popularity, as its protective measures are recognized."

In Annual Report, volume 9, covering the period of time from May, 1899, to July, 1900, is to be found this report to "His Excellency, Murphy J. Foster, Governor of Louisiana," dated April, 1900, issued during the first year of Gen. Leon Jastremski's regime as commissioner of agriculture and immigration, and upon the subject of the fertilizer law, this reference is made: "No better evidence of the efficacy of farmers' institutes and of the agricultural experiment stations in agricultural instruction and progress could be offered than the increased quantities of commercial fertilizers used, as shown in the report of Dr. W. C. Stubbs, which will be herewith transmitted. The receipts from the tagging of fertilizers for the current season will show an additional increase over the past year. The law is operating satisfactorily and few complaints have been made."

In supplementary report by Commissioner J. G. Lee, under date May 1, 1902, to His Excellency, W. W. Heard, Governor of the State of Louisiana, this statement is found, which eventuated in the enactment of the cotton seed meal fertilizer law, in the legislative sessions of 1902: "It would not be proper to leave this subject without calling your attention to the great demand which we are receiving from farmers and planters from every quarter of the State for the inspection of cotton seed meal which was excepted at the time the fertilizer act was framed. There is no doubt at all that great fraud is being practiced in its adulteration, both as fertilizer and as feed, and since cotton seed meal forms the basis of all fertilizers sold in the State, except tankage, it is very important that its quality should be guaranteed. Many of the States include it in their fertilizer law and I so recommend that this act be so amended as to place it under the provisions of this act."

So, up to volume 8, Annual Report of 1898-1899, each biennial report from 1888, has some reference to the operation of the fertilizer law, though in none of these reports does any accurate record of fertilizer inspections exist.

Thus, from a research of biennial reports of the Bureau of Agriculture, and tracing the records of biennial statements made by Commissioners Bird, Adams, Newson, Carter, Lee, Jastremski and Lee, through the administrations of Governors McEnery, Nicholls, two terms of Gov. Foster, and part of our present executive, Gov. W. W. Heard's term, three years of prosperity passed; after tracing the annual fertilizer bulletins from Bulletin No. 25, dated October, 1888, consulting Bulletins Nos. 17, 18 and 25 of the first series, and Nos. 1, 12, 18, 23, 31, 39, 45, 49, 54 and 58 of the second series, all of which show reports of analytical and laboratory work, with full and most complete information as to the work performed by the State Chemist Department—but which in no wise assist in the determination as to actual field inspection work done by the inspectors of fertilizers, if any were in the field—the first official recognition to be given the Inspection Department, in public report, is to be found in Bulletin No. 65, issued during the latter part of the year 1901, though reference to inspection work is to be found in Commissioner Lee's supplemental report of May, 1898. These facts are stated plainly that my inability to make a more complete report might be better understood. There is every reason to assume from the biennial reports of 1890, 1892, 1894 and 1896 that the methods of obtaining fertilizer samples for these years, allowed by Section 9, Act 51 of 1888—a section perpetuated in both provisional re-enactments of 1894 and 1898, i. e., that samples were drawn from consignment by the purchaser in the presence of the dealer and one witness and forwarded to the commissioner of agriculture for analysis, properly labeled and sealed. Thus for eight years following the enactment of one of the best intended laws that could strengthen the conditions of an agricultural people there has been followed out the execution of this law's requirements to an extent, surpassing in the work, it is to be hoped, than appears by so limited references to the same, in biennial reports from 1888 to 1898. This important branch of the service deserves as much recognition as the State Chemist's Department, by virtue of the fact that under present conditions one could not exist without the other. From 1898 up to the present time, more consideration has been paid the publication of the work of the Inspection Department by virtue, perhaps, of more work having been performed along this line, and it is to be hoped that this good policy will continue.

In consulting the books of the State auditor's office, from 1887, an item is to be found, dated May 25, 1894, indicating that John C. Vaner acted as fertilizer inspector for a short period of time from that date. The name of M. O. Bienil appears, dated July 1, 1895, while Mr. Jas. F. Finnegan (February, 1896), completes the number of names of parties appearing up to, and including, the year 1896 who acted as fertilizer inspectors, though the official report records do not indicate that these parties made any report of their work.

Mr. W. L. Clark, Jr., (April 5, 1897), was the first fertilizer inspector under the administration of Commissioner Lee; E. A. Dennett (March 3, 1898), second; J. J. Waddill (September 7, 1898), third; W. T. Jones (January 17, 1899), fourth; S. P. Colvin (January, 1899), fifth; Jno. A. Texada (January, 1899), sixth; M. S. Perkins (February, 1899), seventh; N. S. Williams (February, 1900), eighth; Chas. H. O'Rourke (October 22, 1900), ninth; J. C. Murphy (October, 1900), tenth; N. E. Calhoun (September, 1900), eleventh; Ben H. Lyons (April, 1901), twelfth; E. T. Sellers (February, 1903), thirteenth, while for the year 1898 there are reports of inspections made by N. S. Dougherty.

By consulting "Records of Inspections" books from the years 1898, 1899, 1900, information as to the names of inspectors of fertilizers are shown, though while a record of paris green and fertilizer inspections exist for these years, though not totalized, scarcity of time will not permit of this being done at the present time. It will be found by consulting these records that the following official inspectors of fertilizers were in the field at the periods of time indicated, and to make complete this record, the names are shown under the name of the district they were appointed to:

New Orleans District—March 7, 1898, E. A. Dennett; September 7, 1898, J. J. Waddill; October 22, 1900, Chas. H. O'Rourke.

Baton Rouge District—March 24, 1898, N. S. Dougherty; January 17, 1899, M. S. Perkins.

Terrebonne District—January 17, 1899, W. T. Jones, Franklin, La.; January 29, 1900, N. S. Williams, Gibson, La.; October 1, 1900, J. C. Murphy, Murphy P. O., La.

Calhoun District—March 11, 1898, S. P. Colvin, Ruston, La.; November 17, 1900, N. E. Calhoun, Calhoun, La.

Leesville District—February 20, 1901, Ben H. Lyons, Leesville, La.; February 10, 1903, E. T. Sellers, Alexandria, La.

Mr. J. A. Texada (February 3, 1899), was located at Boyce, La.

Upon entering the duties of inspector of fertilizer and paris green, for the State Board of Agriculture and Immigration, in the New Orleans District, October 22, 1900, my initial work was greatly facilitated by the valued information given me by my predecessor, Mr. J. J. Waddill. In justice to this gentleman, I desire to state that the form of the present inspection report blank, and the system of reporting, with the standard of sample box now in use are due to his judgment, as they were established, and that the information of fertilizer tonnages for the season 1899-1900, which will be referred to later on, are to be found in book on hand in this office, posted by Mr. Waddill. These records show that for the season 1899-1900 there were 12,338 tons of fertilizers shipped to points in Louisiana, the only available records to compare from. For the season 1900-1901 there were 43,558 tons shipped, an increase of 13,256 tons over the season 1899-1900. (See Fertilizer Bulletin 65.) The continued growth of the fertilizer business in Louisiana is exemplified in annual statistical table of comparison, fertilizer tonnages, which appears in Bulletin 73, for the seasons 1900-1901, 1901-1902. As compared with season 1900-1901 (43,558 tons shipped) the total number of tons of fertilizers shipped during the season 1901-1902 amounted to 49,204 tons, an increase of 5,646 tons over the previous year.

For the season 1902-1903 a total of 67,922.60 tons of fertilizers were shipped to points in Louisiana, showing an increase of 18,718.18 tons over the previous year, of which 22,213.10 tons constitutes cotton seed meal fertilizer, a commodity made amenable to the fertilizer law (Act 126 of 1898) by Act 48 of 1902, effective on and after September 1, 1902. Thus, from a tonnage standpoint, in considering the growth of business, by consulting the records of the State Board of Agriculture and Immigration's Fertilizer Inspection Department, we find a tonnage grown from 6,733 tons in 1886-1887, to the gratifying amount of 67,922.60 tons in 1902-1903. The growth has been gradual, though the bulk of this handsome increase must be allotted to the seasons since 1899-1900. This gratifying result of progress has been divided in its growth throughout the inspection districts of the Inspection Department, as will be noted by the compilation of figures given in the tabulation below:

	Season 1900-1901		Season 1901-1902		Season 1902-1903	
	Inspections.	Tons.	Inspections.	Tons.	Inspections.	Tons.
Calhoun District.	229	2,768	325	4,780	535	8,502.60
Leesville District	25	335	101	1,401	100	1,363.05
Terrebonne Dis..	243	8,017	228	7,775	346	12,364.35
Baton Rouge Dis	104	5,243	177	7,127	597	13,892.80
New Orleans Dis.	1793	27,193	2057	28,118	2483	31,799.80
Total number inspections	2394		2888		4061	
Total number tons shipped...		*43,556		†49,201		67,922.60

*Two tons short. †Three tons short.

These figures compiled from Fertilizer Bulletins Nos. 65, 73 and tabulations that will appear in Bulletin No. 76. Fractional part of tons not shown in above tabulation.

So as not to conflict these facts with report of revenues for the past seventeen years, and especially with records of tag sales for tonnage, which will be presented later, I would call your attention to the fact that while these annual reports of fertilizer tonnage shipped by manufacturers and dealers to points in Louisiana are compiled from individual reports of State inspectors and their sub-inspectors, and accurate insofar as any mathematical calculations of this nature are apt to be, there is bound to exist that differential between the figures giving the number of tons shipped and the number of tons tags were sold for, in a given season, by virtue of the fact that it is more often the case with manufacturers to have tags left on hand at the end of a season than otherwise. To my personal knowledge, over 21,000 tags, sufficient to cover 1,558 tons of fertilizer, were recently re-stamped for the season 1903-1904 and returned to one fertilizer manufacturing establishment who had purchased them during the season 1902-1903. The records of tag sales for the season 1902-1903 show that 1,382,859 tags were sold, while the report of the Inspection Department for the same season shows that only 1,211,165 sacks were shipped. As your Inspection Department has nothing to do with the sale of tags or the changing or exchanging of tags, and to avoid any misunderstanding of the figures given in this report, this statement is made.

During the legislative session of 1902, and to meet the requirements of conditions existing in the cotton seed meal commerce of the State, a law was passed (Act 48 of 1902) amending Act 126 of 1898, making cotton seed meal, when used as a fertilizer, a commodity to which the State fertilizer law applied. State Chemist W. C. Stubbs has found a repetition of this law necessary to his report, and I respectfully refer the attention of those who are not acquainted with the wording of the law, to this part of the State Chemist's report, that will be printed with this report and to which I have the honor to refer.

After a thorough organization of districts during the two years previous to 1903 had been perfected and their identity well established, and maps printed and distributed to the different manufacturers and dealers doing business in fertilizer in Louisiana, perfecting a better method of record keeping and the establishment of the New Orleans office as a main office for the handling and checking of all fertilizer samples en route to the State Chemist Department, a better system for the control of tankage inspection, necessitating the keeping of a record of each individual shipment made to a point in Louisiana, by the New Orleans office, we were well prepared to enter into the season 1902-1903 with its increased burden of work, resultant from the enactment of Act 48 of 1902,

The inspection of sixty-seven thousand tons of fertilizers seems but a simple task when reduced down to the medium of transmission by report to printer's ink, but the activity in this line of work for the Inspection Department has taxed every inspector connected with this branch of the service to his fullest capacity. The work performed in every district is highly creditable and presents a system for the inspection of commercial fertilizers unsurpassed by any other State in the Union. The business has increased steadily, since 1899, as an evidence of which a table showing the business for the past seventeen years is given herewith:

NAME OF GOVERNOR	NAME OF COMMISSIONER.	Season...........	Number Tags Sold..........	Number Tons Tags Sold For......	Amount Received for Fertilizer Tags..............	Cost of Fertilizer Inspections, Traveling Expenses, Cost of Tags, Printing and Clerk Hire.........	Amount paid to State Chemist Department for Analyses and Support State Experiment Stations
Samuel D. McEnery	Thompson J. Bird	1886-1887	91,185	6,733	3,366.50	1,866.50	1,500
Samuel D. McEnery	Thompson J. Bird	1887-1888	110,200	8,199	4,099.50	2,899.50	1,200
Francis T. Nicholls.	Thompson J. Bird	1888-1889	153,185	10,219 50	5,109.75	2,109.75	3,000
Francis T. Nicholls.	Thompson J. Bird	1889-1890	171,267	11,120	6,121.55	1,121.55	5,000
Francis T. Nicholls.	Thos. S. Adams...	1890-1891	188,510	11,371	5,686	1,686	4,000
Francis T. Nicholls.	Thos. S. Adams...	1891-1892	128,308	7,945	3,972.50	1,572.50	2,400
Murphy J. Foster...	Henry C. Newsom	1892-1893	164,586	12,041	6,624 15	2,624.15	4,000
Murphy J. Foster...	Henry C. Newsom	1893-1894	133,846	8,436.50	4,932.25	1,142.49	3,789.76
Murphy J. Foster...	A. V. Carter.......	1894-1895	65,772	4,783.20	2,391.61	1,641.61	750
Murphy J. Foster...	A. V. Carter.......	1895-1896	141,430	10,051	5,026.25	1,670.07	3,356.18
Murphy J. Foster...	J. G. Lee..........	1896-1897	174,210	12.543	6,275	3,755	2.500
Murphy J. Foster...	J. G. Lee....	1897-1898	197.630	14.404	7,203.60	503.60	6,700
Murphy J. Foster...	Leon Jastremski..	1898-1899	327.076	23,866	5,970.56	5,079.95	890.61
Murphy J. Foster...	J. G. Lee..........	1899-1900	407,865	31,813	7,953.46	1,481.81	6,471.65
W. W. Heard	J. G. Lee..........	1900-1901	747,322	47,943	11,988.57	5,327.81	6,660.76
W. W. Heard.......	J. G. Lee..........	1901-1902	884,930	53,874.50	13,449.97	6,449.91	7,000
W. W. Heard.......	J. G. Lee..........	1902-1903	1,382,859	77,660.20	19,415.05	9,636.97	7,500

Cash on hand to the credit of the fertilizer fund after all expenses for the season 1902-1903 were paid, except printing Annual Fertilizer Bulletin, $2,278.08.

When we consider the reduction of the inspection fee from fifty cents to twenty-five cents in 1898, in consulting this tabulation of revenues arising from the sale of fertilizer tags, for the past seventeen years, we must realize the magnificent progress made in this department since 1898. The sale of tags for the season 1902-1903 is nearly eight hundred per cent greater than in 1886-1887, and over three hundred per cent of this handsome increase has occurred since 1898. While the enactment of Act 48 of 1902, which makes cotton seed meal, when used as a fertilizer, applicable to the fertilizer law of Louisiana (Act 126 of 1898), has exercised a very marked influence upon the growth of this revenue, the progress in the sale of other grades of fertilizers is easily understood by consulting the figures as shown above, up to and not including the revenues for the season 1902-1903. These tabulations compiled from the records and books of the Baton Rouge office, go to evidence the result of a well organized and systematized department controlling the inspection of fertilizers marketed in Louisiana.

The enactment of Act 48 of 1902, made it necessary for the establishment of a system to control the inspection of cotton seed meal fertilizer shipped to points for use in Louisiana. After careful consideration and due deliberation, in conjunction with the fact that the business for the season 1901-1902 had taxed the Inspection Department to the fullest extent, it was decided best to handle the bulk of the cotton seed meal fertilizer business by the appointment of sub-inspectors at points in the different inspection districts convenient for the handling of the increased business. With this idea in view, a Sub-inspection Department was established in Baton Rouge, Calhoun and Terrebonne Districts under the supervision of Inspectors Perkins, Calhoun and Murphy. The work performed by these inspectors has been highly creditable, the promptness and dispatch in the performance of their duty redounding to the honor and credit of this department. I cannot refrain from according them a hearty acknowledgment for their valued service and expressing a deep appreciation for the same. Following is a list of names of the different sub-inspectors, showing their district location and amount of work done by each during the season 1902-1903:

BATON ROUGE DISTRICT, MILLARD S. PERKINS, INSPECTOR.

	No. Inspections.	No. Tons.	No. Sacks.
Irwin Maginnis, Alexandria, La...	37	431.05	8,613
H. R. Bell, Alexandria, La........	60	284.60	5,682
D. I. Muldoon, Alexandria, La....	72	1,180.30	23,606
Henry Frith, Bunkie, La.........	81	2,165.25	43,305
J. L. Mornhinveg, Opelousas, La..	85	2,008.50	40,170

Total number of inspections made by sub-inspectors, 335; number of tons cotton seed meal fertilizer inspected, 6,069.70; number of sacks cotton seed meal fertilizer shipped, 121,376.

CALHOUN DISTRICT, N. E. CALHOUN, INSPECTOR.

	No. Inspections.	No. Tons.	No. Sacks.
J. J. Richards, Lake End, La.....	3	145.	2,900
A. A. LeRosen, Shreveport, La....	19	390.10	7,802
J. E. Ransom, Monroe, La.......	64	1,956.40	39,126
A. B. Cudd, Minden La..........	47	295.70	5,914
Elmo Colvin, Ruston, La.........	12	167.35	3,347
Thos. H. Brown, Homer, La......	51	360.55	7,211
H. O. Scott, Vidalia, La.........	16	848.	16,960

Total number of inspections made by sub-inspectors, 212; number of tons cotton seed meal fertilizer inspected, 4,163.10; number of sacks cotton seed meal fertilizer shipped, 83,260.

TERREBONNE DISTRICT, J. C. MURPHY, INSPECTOR.

	No. Inspections.	No. Tons.	No. Sacks.
J. K. Milacon, Breaux Bridge, La..	33	759	15,180
A. A. Morgan, Lafayette, La......	17	527	10,540
T. L. Broussard, St.Martinsville, La.	27	1,250	25,000
S. J. Bonvillain, New Iberia, La...	47	1,179.25	23,585

Total number of inspections made by sub-inspectors, 124; number of tons cotton seed meal fertilizer inspected, 3,715.25; number of sacks cotton seed meal fertilizer shipped, 74,305.

Therefore, 671 out of 4,061 inspections made by this department, covering 13,948 tons, 278,941 sacks, of cotton seed meal fertilizer, were handled by the Sub-inspection Departments of Baton Rouge, Calhoun and Terrebonne Districts, as per above statement, compiled from individual reports. These sub-inspectors report each inspection of cotton seed meal fertilizer they make, and forward their report with sample obtained from shipment to the inspector of the district in which they are located. Each sample is sealed by means of a copy of the inspection report being pasted entirely around the pasteboard box, and when the inspector for the district obtains a sufficient number of these samples, they are forwarded to this office in lots of twenty-five and fifty. Each subinspector makes out his report with four carbon copies—retaining original report for his information; sending district inspector duplicate, commissioner quadruplicate copy, New Orleans office triplicate copy, and the fifth copy is pasted around the box containing sample and is sent to the State Chemist Department. By this system five complete records of the subinspection work are obtained and three checks to each sub-inspection that has maintained beyond a doubt the correctness of our report records, is established. This work is very carefully performed and if the State chemist's report refers to this branch of the service I think he will verify this satisfactory condition.

To facilitate the transportation of these fertilizer samples we have established a sample-express-case system. These cases have been made in two sizes. One size will hold twenty-five sample boxes; the larger size case will hold fifty sample boxes. Three cases are used for each district, and three for the transportation of samples between the New Orleans office, 714 Union street, and the State Chemist Department, Audubon Park, New Orleans—twenty-seven cases in all. By this system a case is in possession of each interested party, while one is in transit. Arrangements have been entered into with express companies and the cases are returned to original shipping point as "empties," at a reduced rate, like in the produce business with empty egg cases. The business has developed to a point that warrants a local express concern to return these cases from the State Chemist Department to this office free of cost, and the sample-express-case feature has not only facilitated the work but has offered a means of properly protecting the samples obtained by representatives of this department while the same are being transported to this office and to the State Chemist Department.

The supervision of this new law and the establishment of a system that would meet the requirements; the advertising, correspondence and demands upon the Fertilizer Inspection Department for each inspector's attention has been great. Every cotton seed oil mill in Louisiana, Mississippi, Arkansas and Eastern Texas, and every person whom we were able to find out were interested in cotton seed meal shipments to points in Louisiana, were notified of the law; copies of the law (Act 126 of 1898) with Amendment Act 48 of 1902 being sent them. A number of seizures were made of cotton seed meal fertilizer shipped in violation of the law, but in each instance the shipments were released upon payment of all costs arising from seizure, by the shipper, fines not being exacted owing to the fact that the season of 1902-1903 was the first season in which the law was operative. We are now starting out upon the second year of this law's existence with prospects very favorable for a satisfactory season. The manufacturers and dealers doing business in cotton seed meal fertilizer in this State are more fully acquainted with the law and a compliance with the law as a result of this and a perfected system of inspection will prevail.

During the past season 22,213.10 tons, 444,844 sacks, of cotton seed meal fertilizer were shipped to points in Louisiana, covered by 892 inspections, as follows:

	No. Inspections.	No. Tons.	No. Sacks.
Inspections made by sub-inspectors	671	13,948.05	278,941
BATON ROUGE DISTRICT—			
Millard S. Perkins, Inspector	112	2,703.30	52,773
CALHOUN DISTRICT—			
N. E. Calhoun, Inspector	11	228.25	4,565
LEESVILLE DISTRICT—			
E. T. Sellers, Inspector	2	19	380
TERREBONNE DISTRICT—			
J. C. Murphy, Inspector	33	1,980	39,600
NEW ORLEANS DISTRICT—			
Chas. H. O'Rourke, Inspector	63	3,334.50	68,585

Total number of cotton seed meal fertilizer inspections, 892; total number of tons cotton seed meal fertilizer shipped, 22,213.10; total number of sacks cotton seed meal fertilizer shipped, 444,844.

In compliance with the law, there was, in Bulletin No. 25, and the first bulletin published after the original fertilizer law, Act 51 of 1886, had been passed, a list showing that thirty-three different brands of commercial fertilizers were duly registered by ten manufacturers and dealers for the season 1888-1889. The registration of brands of fertilizers have varied in number from season to season, since the operation of the fertilizer law commenced, though it is only in recent years that an impetus has caused a steady increase in number with the growth and expansion of business. Experiments and new methods have added greatly to this growth of registrations of fertilizer brands, while competition in the fertilizer business has been an influence. For the season 1902-1903, ninety-fo manufacturers registered two hundred and forty-nine brands of fertilizers, classified as follows:

	Manufacturers.	No. of Brands.
Commercial	23	175
Tankage	13	13
Cotton Seed Meal	58	61
Total	94	249

This reference to brand registrations does not apply to the numerous shipments of fertilizers made without guaranteees, or registrations, under the classification of "Special Formula," "Private Formula," etc., referred to in my annual report for the season 1902-1903.

The tankage business in Louisiana has grown to handsome proportions and is used chiefly in the sugar sections where high ammonia fertilizers are sought. Below will be found a comparison of tonnages that gives a clear idea of this class of fertilizer business, so far as the work of this department is concerned, for the past three seasons:

Season 1900-1901	16,007.56 tons shipped
Season 1901-1902	18,973.97 tons shipped
Season 1902-1903	14,478.90 tons shipped

The decline in tonnage of this class of fertilizers for the season 1902-1903, as compared with tonnages of two previous seasons, is partly attributed to the severe weather conditions prevailing throughout the State during the early part of 1903, and to high water in the Mississippi river, and crevasses. This tankage tonnage has been handled by the different inspection districts of this department as follows:

	Season 1900-1901	Season 1901-1902	Season 1902-1903
Baton Rouge District	3,691	4,729.50	3,489.30
Terrebonne District	7,971.56	7,763.98	6.656.60
New Orleans District	4,345	6.480.49	4,333
	16,007.56	18,973.97	14,478.90

The commercial fertilizer business has continued in its growth, and from available records I am enabled to show in this report the growth in this branch of the fertilizer business in Louisiana, by districts, since 1900-1901—the records for 1899-1900 only showing that a total of 17,964.35 tons were shipped. Of course, you understand that the term "commercial fertilizer," as we apply it, refers to all fertilizers excepting straight cotton seed meal fertilizer and tankage. The below tabulation, compiled from annual statistical reports of fertilizer tonnages for the seasons 1900-1901, 1901-1902 and 1902-1903 (copies of which appear in Fertilizer Bulletins Nos.

65, 73 and 76), will give an idea as to the growth of business in this branch of fertilizer commerce in Louisiana since 1899:

	Season 1900-1901	Season 1901-1902	Season 1902-1903
Baton Rouge District	1,552.86	2,398.	1,630.50
Calhoun District	2,768.15	4,780.98	4,111.25
Leesville District	335.75	1,401	1,344.05
Terrebonne District	46.50	12	12.50
New Orleans District	22,847.57	21,638.47	24,132.30
	27,550.83	30,230.45	31,230.60

Recapitulated, irrespective of classification, the work of the Fertilizer Inspection Department throughout the different districts for the past three years, in tonnage, is as follows:

	Season 1900-1901	Season 1901-1902	Season 1902-1903
Baton Rouge District	5,243.86	7,127.50	13,892.80*e*
Calhoun District	2,768.15	4,780.98	8,502.60*x*
Leesville District	335.75	1.401.	1,363.05
Terrebonne District	8,017.56	7,775.98	12,364.35*v*
New Orleans District	27,193.07	28,118.96	31,799.80
	43,558.39	49,204.42	67,922.60

e 6,069.70 tons of this tonnage inspected by subinspectors.
x 4,163.10 tons of this tonnage inspected by subinspectors.
v 3,715.25 tons of this tonnage inspected by subinspectors.

As to the number of inspections made, the following compilation of figures will evidence the increase of business from a standpoint that verifies the statement that the Fertilizer Inspection Department is taxed with work to the fullest extent:

	Season 1900-1901	Season 1901-1902	Season 1902-1903
Baton Rouge District	104	177	597*e*
Calhoun District	229	325	535*x*
Leesville District	25	101	100
Terrebonne District	243	228	346*v*
New Orleans District	1,793	2,057	2,483
	2,394	2,888	4,061

e 335 inspections of this total number made by subinspectors.
x 212 inspections of this total number made by subinspectors.
v 124 inspections of this total number made by subinspectors.

The transportation of 1,211,365 sacks of fertilizers, aggregating in weight 67,922 tons, requires about sixty-five trains of fifty cars each—a length of railroad cars, if placed in one continuous line, would extend twenty-five miles in length. The system for the inspection of this steadily increasing business has reached a most gratifying state of efficiency. The planters and farmers have all been most courteous. We have accomplished a work that deserves their good will, and enjoying the good will and confidence, we must continue to be worthy by following out to the interest of all, the exact wording of the fertilizer law.

The business has now reached proportions that make this branch of the service very important. The planters and farmers have long since realized the value of the law, while manufacturers enjoying protection from the evil of spurious competition have come to recognize the law as commendable. As a result of the efficiency of the work, both in this and the State Chemist Department, the report of analysis of the State chemist is often used as a basis of settlement between the buyer and seller of fertilizers in Louisiana.

And as the business has grown in years gone by, so will the same continue to prosper in a future that holds forth so much of wealth in a State so rich in soil; and as education continues onward the march of science and the value of rotation and fertilization of crops become better understood, this continued growth will still prevail until the State of Louisiana has reached the height of her agricultural zenith and shall have then reached a stage in the fertilizer business that is now practically in its infancy.

Respectfully submitted,
CHAS. H. O'ROURKE,
State Inspector of Commercial Fertilizers and Paris Green, New Orleans District.

Main Office, Fertilizer Inspection Department, 714
Union St., New Orleans, La., Nov. 30, 1903.

SECOND SERIES, NO. 77.

BULLETIN

—OF THE—

AGRICULTURAL EXPERIMENT STATION

—OF THE—

Louisiana State University and A. & M. College.

W. C. STUBBS, Ph. D., Director and State Chemist.

RICE:

History, Preparation of Soil, Planting, Flooding, Harvesting, Noxious Weeds in the Rice Fields; Feeding Rice Bran and Rice Polish and Determination of Digestible Nutrients.

By W. C. STUBBS, W. R. DODSON, C. A. BROWN.

ISSUED BY THE LOUISIANA STATE BOARD OF AGRICULTURE AND IMMIGRATION,
J. G LEE, COMMISSIONER.

BATON ROUGE, LA
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Louisiana State University

and A. & M. COLLEGE.

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The Bulletins and Reports will be sent free of charge to all farmers, by applying to Commissioner of Agriculture, Baton Rouge, La., or to the Director of the Station, Audubon Park, New Orleans, La.

PREFACE.

The rapidly increasing production of rice in this State, and the numerous inquiries made by prospective purchasers of land with a view of entering upon the cultivation of this plant, has caused an unusual demand for literature on this subject. Bulletin 61 has been exhausted in supplying this demand, and the inquiries continue to come in such abundance as to justify a republication of this bulletin, revised and extended to include additional information gained through recent experiments, especially pertaining to the feeding value of the by-products of the rice mills.

New weeds have appeared that call for discussion. Other points have developed which enables us to make this publication more valuable than the preceding bulletin referred to.

The United States Department of Agriculture has issued two bulletins from the pen of our able and distinguished citizen of Lake Charles, La., Dr. S. A. Knapp. Besides the information gathered from a long experience and observation in the rice fields of Southwest Louisiana, he has recently visited the Philippine Islands and Japan, on a special mission of the Department of Agriculture at Washington, to study the rice industry of those islands and to select that variety which would probably be best adapted to the environments of the Louisiana planter.

Many tons of rice seed were imported by him, and through the Department of Agriculture and members of Congress, distributed throughout the rice districts of the United States. This thorough study of the rice industry of other countries, added to a previous knowledge of and familiarity with our own, pre-eminently qualified this able scientist to speak upon the rice question.

"The Present Status of Rice Culture in the United States," Bulletin No. 22, of the Division of Botany; and Farmers' Bulletin No. 110, "Rice Culture in the United States," are the two bulletins mentioned above, and should be in the hands of every rice planter.

Much of the information relative to the preparation of the soil, planting, etc., in this bulletin, has been obtained from successful rice planters either by personal interview or correspondence.

Besides the general information relative to the planting, growing and harvesting of this crop, this bulletin will contain a great deal of information relative to the noxious weeds found in the rice fields of this State, gathered by Prof. W. R. Dodson, botanist of the stations, in personal trips of investigation throughout the rice districts of the State. These weeds are fully described and illustrated, with suggestions as to their destruction, etc. This will be found in Part II of this bulletin.

Dr. Brown and Prof. Dodson have conducted experiments determining the digestibility of rice bran and rice polish, and feeding experiments have been carried on using the bran as the chief carbohydrate concentrate in beef production. Dr. Browne has also investigated the adulteration of rice by-products, and the results of the above investigations are given in Part III.

This station has previously issued four bulletins on rice: No. 15, "Rice;" No. 24, "Rice and Its By-Products;" No. 50 (second series), "Red Rice," and No. 61, "Rice Preparation, Cultivation, Flooding, Harvesting; and Noxious Weeds in the Rice Field." All of these bulletins are out of print, except No. 50, of which a few are still available.

Bulletin 113, office of Experiment Stations, on "Irrigation of Rice in the United States," by Frank Bond and George H. Keeney, contains valuable information on irrigation.

RICE.

The botanical name for our common rice is *Oryza sativa.* The word *Oryza* was coined by the Greeks from the Asiatic word "eruz," and our modern nations have modified it into "rice," "riz" and "reis."

There are five species of rice described by botanists, though it is probable that they are only varieties: *Oryza sativa,* our common rice; *Oryza mutica,* dry or mountain rice; *Oryza praecox,* early rice; *Oryza glutinosa,* clammy rice, and *Oryza rufipogon,* red rice.

The common rice is the only one cultivated in Louisiana, though the red rice has contaminated it to a large extent in many of our rice fields and greatly injured the value of the former.

The antiquity of rice is very great, as the origin of its name indicates, and its native habitat is unknown.

It is cultivated largely in India, China and Japan, and also sparingly in Europe. In Carolina it has long been a staple commodity, its introduction into this State being made as far back as 1698, "by a small bag of paddy given as a present from Dubois, treasurer of the East India Company, to a Carolina trader."

It is also said that a Dutch vessel from Madagascar brought rice subsequently to the same State and to this is attributed the presence of two kinds there now.

CROP OF LOUISIANA.

The rice crop first assumed noticeable proportions in this State directly after the war, when the abandoned sugar plantations suggested the possibilities of growing rice on a large scale. The success attending the first ventures stimulated others to follow, and soon every abandoned acre on the Mississippi river and its bayous were utilized in the culture of rice. In 1885, attention was called to the successful efforts of the Duson Brothers, now of Crowley, La., in growing and irrigating a large field of rice near their old home. This beginning attracted settlers from the West and Northwest, who brought with them the latest machinery used in the wheat fields, and began at once to adapt them to rice culture. Success attended their efforts and rice culture became revolutionized. The character of the soil, the availability of water for irrigation, and the introduction of improved machinery, all rendered the problem of rice culture in Southwest Louisiana easy and profitable. Thousands flocked into this section to go into this profitable industry, and the area in rice has increased till Louisiana is by far the leading rice producing State of the Union.

In 1896 Louisiana produced 127,600,000 pounds of clean rice, while North and South Carolina grew 27,901,440 pounds, and Georgia 10,464,000 pounds. In 1899 Louisiana produced 107,792,000 pounds, North Carolina, 2,560,000 pounds, South Carolina 23,054,720 pounds, and Georgia 3,584,000 pounds.

In 1902 the crop was about 535,000,000 pounds of rough rice, of which Louisiana and Texas produced more than four-fifths.

It is estimated that the crop of Louisiana and Texas for 1903 will almost reach three million bags, of 160 to 170 pounds each. Should each bag mill 100 pounds of clean rice, the crop will approach 300,000,000 pounds of clean rice. This will not be four and a half pounds per capita for the population of the United States.

IMPORTS INTO THE UNITED STATES.

[Preliminary reports of Department of Commerce and Labor.]

ARTICLES IMPORTED.	Year ending June 30, 1903.		Ten months ending Oct. 31, 1903.	
	Pounds	Dollars	Pounds	Dollars
Rice	78,307,010	1,731,915	78,973,168	1,798,668
Rice flour, rice meal, and broken rice	91,349,174	1,329,558	76,726,108	1,133,019
Total	169,656,184	3,061,473	155,699,276	2,931,687

It will thus be seen that our domestic supply is considerably less than our consumption, and there is yet an abundant room for the expansion of this industry without fear of overstocking our supply. Again the consumption of rice per capita is increasing, so also is the population of the United States. It may therefore be asserted that, under most favorable conditions, there is hardly a possibility of our domestic supply reaching the national demand within the next ten to twenty years. The present tariff of about two cents per pound upon cleaned rice, also encourages its increased production.

There is one difficulty to contend with in completely supplying domestic consumption. The Chinese and Japanese on the Pacific coast consume some forty million pounds of rice annually, nearly all of which is imported. Some effort has been made to gain this trade to Louisiana and Texas, and considerable quantity of rice has been sold by putting it in the kind of packages demanded by these people. However, they demand a small grain, which we are not producing to any considerable extent. No doubt by the proper methods of packing, and the cultivation of the proper variety of rice, we will be able to supply this trade and stop the importation to meet this demand. During 1902 this country sent to Porto Rico over fifty-two and a half million pounds of rice. There seems to be no doubt but that under reciprocity we shall be able to dispose of a large quantity of rice in Cuba in the future.

LAND SUITABLE FOR RICE CULTURE IN LOUISIANA.

Rice can be grown upon any land in this State which can be irrigated. According to the geological survey of this State, there are about 13,000 square miles of alluvial and 3,000 square miles of prairie lands in this State. The topography of most of these areas permit of the easy inundation of water. Nearly every acre of the alluvial lands is adjacent to the Mississippi river or its outlying tributaries, which will supply inexhaustible amounts of water. The Red, the Ouachita, the Mason, the Bœuf and the Tensas could all be used for flooding rice fields on their banks. Mr. Alexander and Mr. Grew, of Ouachita, have recently grown successfully large rice crops, a few miles below the city of Monroe on the Ouachita river, using the water of the latter for irrigation, and Messrs. J. and M. Wade have been growing it on the Choudrant bottoms for several years.

The alluvial section of lower Louisiana is now chiefly devoted to sugar cane, though a goodly area is cultivated in rice The alluvial lands of North Louisiana are exclusively cultivated in cotton and corn, though most everywhere adaptable to the growing of rice. Taking the alluvial and prairie sections of this State and estimating that half could, with some expenditure of money, be brought under cultivation and irrigation, there would be available for rice culture in this State, should there be a profitable demand for this crop, at least four to five million of acres. Estimating the yield of each acre at ten barrels, this would give a crop of forty to fifty million barrels; or at 100 pounds clean rice per barrel, four to five billion pounds of clean rice; or twelve times the present consumption of rice.

As with all crops, rice should form a part of a system of rotation to produce the best results, hence not more than one-half of above estimate should really be counted on through a series of years.

The above will show, however, the large area available for rice whenever the exigencies of our country demand its dedication to this cereal.

The prairies of Southwest Louisiana are fast becoming one vast rice field. This section is comparatively level, with numerous streams permeating it, from which large pumping plants are sending the water through numerous canals on to the fields. It is also underlaid at 150 feet to 300 feet by a stratum of gravel, which, when penetrated, as it is, by numerous wells, affords an abundance of water for irrigation. This stratum of sand and gravel crosses the State from east to west, just above (geologically) the upper group (Grand Gulf) of the Tertiary formation. It runs from near Leesburg on the west, to north of Washington on the east, and has a breadth of many miles and depth of many feet. The rainfall upon this area percolates the gravels and sands which dip beneath the prairies and furnish an ample supply of water for irrigation of fields, or for the use of the thriving towns and villages found in this section. By boring an eight or ten-inch well down into these gravels, the water rises sufficiently near the surface to be pumped by machinery onto the fields or into the stand pipes.

This prarie section is underlaid by an impervious clay subsoil, which aids greatly in economizing the water used and permits the fields to be drained at harvest. Hence the adaptability of improved self-binders in harvesting this crop.

The alluvial lands of the State have not this impervious subsoil, and hence require more water for irrigation and cannot always be drained at harvest, so as to permit of the use of this improved machinery. Hence a greater part of the crop is cut by hand, thus requiring more labor and entailing greater expense in harvest.

They have, however, these advantages: The water supply is always ready and abundant, and the land, sloping gradually toward the swamps, permits of a flow by gravity from front to rear, without the intervention of costly canals.

Both sections have their advantages and disadvantages, and there are planters in each who are reported to be making good profits from rice culture each year.

In Southwest Louisiana there are a large number of wells which, by the aid of proper pumping machiney, are irrigating each eighty to one hundred and fifty acres of rice. These artesian wells are being multiplied daily, and by their use are permitting the cultivation of lands remote from streams and out of range of canals. Also permitting the cultivation of lands whose topography prohibited the economical flooding from canals.

LIST OF RICE CANALS.

The following is a partial list of canals in Southwest Louisiana. Very few wells are included in this list, as it was found almost impossible to get anything like complete data. It is believed the list is fairly complete for the more important plants. Where we have not been able to hear directly from the companies the data is taken directly from the Rice Journal and Gulf Coast Farmer for January, 1903:

NAME AND OFFICE OF COMPANY.	Number Boilers	Total horse power of Boilers	Number of Engines	Total horse power Engines	Capacity of Pumps. Gallons per minute	Fuel	Main Canal. Length, miles	Width Main Canal—Feet	Length Laterals—Miles	Acres Irrigated 1903	Estimated Acreage for 1904
ACADIA PARISH.											
Abbott Bros. Canal & Improvement Co. Crowley	4	.....	3	900	45,000	Oil	14	45	100	5,000	5,000
Abbott, Duson Canal Co., Crowley	15	2375	8	2150	......	Oil	22	....	75	16,000	16,000
Crowley Canal Co., Crowley	9	770	6	675	......	Oil	15	....	25	8,000	8,000
Ferre Canal, Crowley	5	625	4	550	113,000	Oil	25	50	50	12,000	12,000
Freeland Roller Canal, C. J. Freeland, Crowley.	5	950	3	725	......	Oil	15	40	25	8,000	8,000
Green-Shoemaker Canal, Crowley	1	60	1	50	5,000	Oil	1½	20	2½	500	......
Hurd & Wright, Crowley	1	18	1	Relift 18	1-18 inches	......	....	....	....	......	......
	2	185	2	160	3-12 inches	Oil	7	....	7	4,000	......
Midland Canal Co., Ltd., Crowley	..	......	..	......	2-30,000	......	....	....	....	......	......
	4	320	3	250	1-10,000	Oil	6	60	30	4,000	4,000
Miller Morris I. and L. Co., Ltd., Crowley	8	66 x 16	4	600	4-64,000	......	....	....	....	......	......
	2	72 x 16	21	250	3-21,000	Oil	7	80	30	7,000	......
Riverside Irrigation Co., Ltd., Jennings	..	......	1	125	......	......	..	....	....	......	......
	3	375	1	165	4 Relift 12 inches	......	....	....	....	......	......
	2	500	1	250	5-15 inches	Oil	3	50	21	3,000	4,500 Capacity
Roller Canal Co., Crowley	1	100	1	125	......	Oil	7	....	....	......	......
Union Canal Co., Jennings	1	150	1	125	......	Oil	7	75	2	3,100	......
Wilder Canal, P, D. Wilder, Mermentau	2	300	1	165	4,500	Coal	....	....	....	......	......
	3	375	2	375	......	Wood	1½	60	¾	250	800 Capacity
CALCASIEU PARISH.											
Allen Canal, W. Allen, Lake Charles	1	44 x 12	1	35	......	Oil or Wood	1	25	....	140	600 Capacity
Arcenaux Canal, estate J. H. Rhodes, Welsh	..	......	..	......	1-4 feet	......	....	....	...	......	......
	1	100	1	75	Ivens Pump	Wood	1½	30	½	760	......
*Bunker Hill Canal	1	175	1	150	15,000	Wood	4	24	4	400	......
*Calcasieu River Irrigation Co., Kinder	..	......	..	......	......	......	15	140	6½	3,500	......
*A. A. Call Canal Co., Ltd., E. Shoefelt, Joplin	2	160	1	125	......	Coal	3	30	....	1,100	......
Chaupique Irrigation Canal, H. C. Drew, Lake Charles	2	160	1	300	1-20.000	......	...	....	....	......	......
	2	300	1	150	1-50.000	Wood	12	125	8	8,000	......
W. R. Conklin Canal, Jennings	2	51	2	51	......	Coal	2¾	30	1	300	......

Farmers' Canal, N. A. Land and Timber Co., Lake Charles					100,000	Coal, Wood, Oil.	30	120		10,000	
Gauthier Canal, A. M. Gauthier, Jennings	1	150	1	125	1-13 inches	Wood	1½	50		115	1,000
*Grand Canal Co., Ltd., Crowley	6	890	5	962			15	80	6	18,000	
*Holton & Winn, J. W. Mercer, Jennings	2	32	2	32		Oil	2	66		500	
Houston River Canal Co., Ltd	7	1200	3	1000	100,000	Oil and Wood	24	100	32	12,000	
Illinois Canal and Rice Co., Ltd., Jennings	2	300	2	300	80,000	Oil	10	100	6	4,500	5,000
Indian Bayou Canal, P. W. Daniels, Pres., Welsh	2	300	2	250		Oil	23	125	10	6,000	6,000
*Keystone Canal Co., Ltd., Jennings	2	300	2	250	2-18 inches	Oil	7½	100	13	4,000	
Laccasine Irrigation Co., Jennings	1	50	1	150	30,000	Oil	8	40	6	3,000	3,300
C. B. Lake & Co., Ltd., Canal, Lake Charles	2	120									
	2	80	3	315	4-18 inches	Oil	7	80	5	3,000	
Mayville Canal Co., Ltd., Jennings	2	300	3	335	60,000	Oil	7	60	10	5,000	5,000
McFarland Co., Ltd., Jennings	2	700	3		600,000	Oil	20	100	10	6,500	6,500
A. D. McFarland Canal, Jennings	2	120	1	103	15,000	Oil	4½	60	3½	2,300	3,500 Capacity
Missouri Rice Co. Irrigation Canal, Lake Charles			2	20in x42in	2-18 inches I						
	5	600	1	24in x48in	2-24 M		12	150	12	4,000	6,000
Model Farm Canal, Dr. A. J. Perkins, Lake Charles	1	50	1	40	6,000	Oil	1½	30	1½	450	450
*North American Rice Co., Lowry	2	525	2	525	58,000	Oil	16	80		6,000	
Norwood Rice Plt., Taylor, Evans & Carhart, Jennings						Oil.					
	3	280	3	220	40,000	Oil	6¼	55	2	2,000	
Oak Grove Canal, L. Kaufman, Lake Charles	1		1			Wood	1	50	2	500	500
Robinson Canal, E. M. Clark, owner, Welsh			1	375	1-15 inches						
	1	375	2	120	1-24 inches						
	3	315	1	200	1-36 inches		12½	60	22	4,000	7,000
Sabine Canal Co., Vinton	1	450	1	350	40,000	Oil	9	150	5	3,000	4,000
*Southwestern Rice and Irrigation Co., Jennings	6	480	3	675	40,000	Oil, Coal	11½	100	8	10,000	
Unkels Canal, P. J. Unkels, Welsh	2	100	2	75		Oil	3	40	3	600	600
Watertown Farm and Irrigation Co., Crowley	1	120	1	100	1-18 inches	Oil	1½	40	1	560	560
*S. W. Wood & Co., Lake Charles	2	250	2	200	28,000	Oil and Wood	4½	60	4	1,500	
CAMERON PARISH.											
*E. I. Hall Canal, Jennings	2	120	2	100	25,000	Oil	2½	60	5	800	
*Lakeside Canal, Lakeside Irrigation Co., Jennings	2	200	2	160	50,000	Oil	12	100	6	2,500	
LaGonda, Houck Bros., Lakeside	1	65	1	60	16,500		1¼	16		732	
VERMILLION PARISH.											
Abbeville Canal, Abbeville							12	120	7		10,000 Capacity
Hunter Canal, Crowley	3	1500	4	1200	150,000	Oil and Coal	18	200	32	20,000	20,000
L. & H. Canal, Gueydan	4	1000	3	1350	215,000	Oil	50	100		25,000	

Besides the above, the Union Relift Company, with a capacity of 200,000 to 225,000 gallons per minute, throws the water over a dam in Bayou Plaquemine Coulee and thus makes it available for three of the above plants.

VARIETIES OF RICE.

There is an immense number of varieties, varying in quality, yield and time of maturity. The station has imported a number of Japanese varieties and found some of them, though planted in early spring, would not mature before being killed by frost. There was a great variation in time of maturity of the varieties received.

There is also a difference in size, shape, color and composition, and flavor of the grain, and those varieties are selected which are best adapted to our environments. Varieties are sold on our market for seed under the following names: The Carolina, the Honduras and the Japanese. There are strong reasons for believing that these are not confined to distinctly three varieties, since all imported rice seed are usually called either "Honduras" or "Japanese." Dr. Knapp has the following on varieties of rice: "The Gold seed South Carolina rice sells for as much as any rice on the market. The ordinary lowland rices are much better in quality than the ordinary (non-irrigated) upland rice, provided they are grown on soils which can be drained, but there is a great difference in different varieties, especially in the hardness of the grain. The most desirable rice, from the standpoint of the grower, is one which will produce the largest amount of 'head rice,' that is, unbroken grains. Upland rices or lowland rices of poor quality break up during the process of milling, so that the percentage of head rice often averages only forty to thirty, or sometimes even as low as ten per cent. of the entire crop. The Japanese rices average better than the American as far as their milling qualities are concerned, and for this reason it is desirable that the Japanese rices be more extensively introduced into this country, provided they maintain here the same characteristics as in their native country."

Honduras rice is generally raised on the alluvial lands, while the Japanese rice is mostly cultivated in the prairie section. The Honduras rice ripens about two weeks earlier than the Japan, but grows ranker and is more apt to blow down and become tangled and give rise to trouble in harvesting. It is becoming very general in some sections of the prairie to plant both kinds, so as to give a longer harvesting season, as well as to get the benefit of an earlier market.

Whatever variety is selected for seed, it should be pure, free from red rice and the many obnoxious seeds described elsewhere in this bulletin.

Just here a suggestion might be made to those going into rice culture upon lands which have never been cultivated in rice before. If you will select a perfectly pure seed, particularly free from red rice, and grow it with care, keeping it up to its original purity, you will find a market for it as "seed rice" far beyond the price paid for milling rice. This is due to the demand for pure seed, so much of it in Louisiana being adulterated with that intolerable nuisance, "Red Rice." It has been shown by a previous bulletin how difficult it is to exterminate this red rice when once established in the fields.

CULTIVATION OF RICE

varies in different sections of the State and sometimes in different communities in the same section. The alluvial sections as a rule pursue an entirely different method from preparation of soil to the harvesting of the crop, to that followed by the planter upon the prairies.

IN THE ALLUVIAL SECTIONS.

The ditches for drainage run from the levees to the rear at distances of from 100 to 200 feet apart. As before mentioned, the land slopes gradually from the levees to the swamps. This slope, nowhere precipitous, varies in different fields. Cross embankments at intervals to suit this slope, are thrown up with a plow and perfected with the hoe, or shovel, so as to hold back water enough to cover the plants in the upper part of the plat. These embankments cross the old ditches with either plank or earth dams. The size of the plats thus made by the ditches and cross embankments varies with slope of the land and distance between ditches. Usually they are too small to permit of the successful handling of improved machinery in harvesting the crop.

Two methods of preparing the soil are followed, known as the "dry" and the "wet." In the former the lands are plowed in the fall and winter and thoroughly harrowed and seed sown broadcast (or with drill) and harrowed in, similar to planting of oats or wheat. The seed is usually sown in the last days of March or early in April. This method prevails on the upper coast.

In wet culture the fields are flooded and plowed in water. The rice is sown and harrowed in the wet. The water is then withdrawn to permit the rice to germinate. The sowing made directly after plowing is usually done in April or in May. Care must be exercised to prevent the young plants from scalding by the sun at this late period. This custom is practiced by those planters who cultivate black or buckshot clays, because after wetting the soil an ordinary pair of mules can break the land, whereas if dry it will require a four or six-mule team for the same work. However, wet culture has many difficulties unless carefully and judiciously performed.

After the plants are up a few inches high the ground is gradually moistened and the water kept just a little below the tops of the plant until the latter has obtained a good size, when the field is flooded from six to twelve inches deep and kept so until ready for harvest, unless some other disaster overtakes the crop. Should weeds and grass abound they are either pulled out by hand or they are scythed down with the rice, and by flooding, the former are checked or killed and the latter pushed into vigor. During growth a constant but imperceptible flow of water is kept going through the fields. When harvest approaches the water is withdrawn and pumps stopped. The water is now, by law, drawn over our levees through syphons, which, during high water, work automatically, dispensing with expense of a pump.

Ordinarily the water is pumped into a pond on the river side of the levee, formed by an artificial dam so as to bring the surface of the pond higher than the surface of the field next to the levee. The syphon is started and works continuously as the water is pumped from the river into the pond and the surface kept high enough to maintain the operation through gravity. See illustration.

The plowing is usually from four to six inches deep, and a sack of 162 pounds of seed is planted on from two and a half to three and a half acres.

Harvest usually takes place on the river in August. The rice is cut by hand with sickles, laid upon the stubble to cure and afterwards bound into sheaves and put into shocks, where they remain until hauled to the thresher.

In some instances the shocks are bunched till a small stack is formed containing a wagon load of sheaf rice. These stacks are allowed to stand till the rice passes through a "sweat." The rice begins to heat soon after it is bunched, becomes moist from water driven off from the composition of the stem and leaves and grain, the temperature rises till a maximum is reached and then gradually subsides and the stack dries out. This process is probably due to enzymic fermentation, and if it does not occur while in the sheaf it will begin as soon as the grain is put in bulk. When it occurs while the rice is in sheaf, the grain dries out better, hardens better and makes a better milling rice and a better quality of finished product, as it takes a higher polish and shows a whiter pearl grain.

Generally, however, the planter is anxious to get rid of his crop as soon as possible, fearing damage from unfavorable weather.

Improved implements for planting and harvesting the crop have been tried in the alluvial sections, but have not been generally adopted, due to reasons already assigned.

As a rule the river planters strive to place their rice on the market as early as possible, to catch the benefit of the good prices then prevailing.

It is extremely difficult and perhaps unprofitable to cultivate a field continuously in rice on the river. The flooding waters are so filled with grass and weed seeds that the soil soon becomes so charged with these obnoxious plants as either to render the expense of removal excessive, or if left alone, destroy the crop. Hence a rotation of dry culture is imperative every few years.

It is the general custom to grow two crops of rice and then devote the land to something else for a year or more, or let it lie idle for a year, while the strictly aquatic weeds die out.

CULTIVATION IN THE PRAIRIE SECTION

is the evolution of the last 12 to 14 years, and, as has been shown, has been produced by the local factors of environment. In the first place, the impervious subsoil permits of rapid drainage and drying out, when the water is withdrawn. Again, the topography of the country gives large areas of level land, on which improved implements can be used to great advantage. With an abundance of water from canals and artesian wells, added to the above, one finds in this section almost ideal conditions for growing large and profitable crops. Accordingly gang plows, all kinds of harrows, seeders (broadcast and drill) and self-binding harvesters are universally used, and with the exception of flooding the growing crop, and providing levees to hold the water, the culture of rice in Southwest Louisiana varies but little from that of wheat in our Northwestern States. The land is broken with gang plows drawn by four or more mules, and thoroughly pulverized with harrows, and seed sown either broadcast or with drill, at rates of one sack (162 pounds) to three to four acres.

The following intelligent replies to inquiries addressed to Mr. J. F. Shoemaker, of the firm of Green & Shoemaker, of Crowley, one of the most progressive and experienced rice planters in the State, will probably convey information of a practical character to those contemplating embarking in rice culture:

Question—Number of mules to a 500-acre rice farm?

Answer—Twenty; these will run five gang plows. In favorable seasons less might answer for preparing the soil, but this number will be required in harvesting the crop, which would take three harvesters with six mules each, unless ground be unusually good, when five to each machine might do. This leaves only two supernumeraries to take the place of the sore and lame ones which are almost always present on a large farm.

Question—Plows to break with?

Answer—In bad seasons, five 12-inch gang plows would be required to break 500 acres, but in ordinary three, and in very favorable seasons even two would do the work. Would not advise less than three.

Question—Harrows to pulverize?

Answer—The disc and spring tooth harrows are generally used in preparation of the ground. If plowing be done in fall or winter the soil becomes quite compact and requires a surface scarification before seeding. Nothing equals the disc in such work, although if the ground is not too compact the "spring tooth" will do well and pulverize finer than the disc. Where the disc is used it is necessary to follow with a smoothing harrow. Would not dispense with any of them. I keep three of each, which are ample for a 500-acre rice farm.

Question—Do you plow shallow or deep?

Answer—In breaking the native sod I usually plow two to two and a half inches. After lying for a few weeks the soil is disced several times, each time in different directions, finishing with a smoothing harrow to pulverize even the smallest lumps.

If the sod be broken too deep, it is very difficult to get pulverization necessary for a good seed bed. Hence two and a half inches is deep enough. After one crop is taken off, a little deeper plowing is necessary. I never aim to plow over three inches, although some have plowed four or five inches deep and claim good results. Objection to deep plowing is in harvesting; the drive wheel of the harvester will go as deep as you have plowed, unless the ground be very dry. Suppose that after we have taken off a number of crops we may have to go deeper for best results.

Question—Is land flooded before plowing or harrowing?

Answer—It has been done where the ground was so hard that it could not be plowed dry. It is only resorted to as an alternative of letting the ground lie idle.

Question—Are seed sprouted before sowing?

Answer—I have never known it to be done, although the natives used to do it when the custom prevailed of sprouting the seed and sowing in a pond. This was before the days of irrigation. Should seed be sown in water it will rot, hence they sprout before sowing.

Question—Earliest and latest time for planting?

Answer—April 1st to June 10th. Although some plant up to the first of July, such late planting generally meets with failure. If I could set a date I would say planting from April 10 to May 15 for the best results. Honduras will stand planting earlier than the Japan, being a larger and stronger grower, and will make better headway from the start. Where a person sows both kinds the Honduras should be planted first, and it can then be easily taken off first in the harvest.

Question—Do you prefer to broadcast or drill your seed?

Answer—Formerly seed were sown broadcast. In recent

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years the drill is very generally used and is regarded as an improvement over "broadcast." With the drill a more uniform stand is obtained, which means ultimately larger yields. With the drill a good percentage of seed required is saved (some estimating as much as 20 per cent.) by putting it at an even depth, insuring simultaneous sprouting of every seed and a uniform stand.

Question—What machines for planting?

Answer—There are two makes each of the "broadcast" and the "drill." The former are bolted to the rear of a wagon and attached to the wheel of the latter by a chain and sprocket which gives it motion as the wagon is drawn. Cost $12.

The drills are of two makes, either of which do well, and cost $80.

Question—How long after planting before watering?

Answer—Depends largely on the weather and condition of the ground. If the latter be moist and the weather warm so as to produce a good growth, four to six weeks will make it high enough for water. If ground is dry and there is a slow growth of the plant, ten weeks would find it small for flooding. In the latter case, if water be abundant, it would be well to flood and draw off the water as soon as ground is soaked. A person having several cuts can fill the highest one, and then pass the water to the next, and so on, till all are wet. It is necessary to fill the cut full of water before passing it to the next in order to get the highest points wet. By this process a mimimum of water is used.

Rice should not be flooded over its top, but fields may be treated as above without detriment to the young plants. When rice on the lowest part of the field is large enough to stand a few inches above the water, then ought permanent flooding be started.

Question—Do you prefer deep or shallow flooding?

Answer—I give each cut a fall of six inches and I fill this cut so that the rice on the highest part will be one inch under water. Some construct their levees so as to have only five-inch fall, which is better, provided it does not give too narrow cuts. Some give greater fall than six inches, but by doing so I believe they get too much water on the rice in the lowest parts. Too much water causes a weak straw. Experience has taught me that too much water causes the rice to fall down, when the water was withdrawn for harvest. Nor were my yields as good in deep water as in shallow water, even where the general appearances were the same. If I could control the depth desired, I would say not more than four inches. Rice being indigenous to a hot climate, needs much heat, especially at the roots. If the water is too deep it prevents the proper amount of heat at the roots. This is detrimental to the filling of the grain.

Question—In any average season how long do you flood?

Answer—Not far from three months.

Question—How long before harvest do you draw off the water?

Answer—About the time the rice is passing into the dough and the heads begin to turn down, which is usually about ten to fourteen days.

Question—What harvesters are used, and area per day?

Answer—The Deering and McCormick are the harvesters commonly used. They cut either five or six feet, and the area cut per day varies with the conditions of crop and ground, within wide limits, say from five to twelve acres.

Question—How many hands are needed to shock with each harvester?

Answer—Varies with the weight of crop and conditions of the ground; generally two.

Question—Usual method of threshing?

Answer—By same machines used for oats and wheat. The usual price of threshing, when the farmer supplies the hands, is ten cents per sack of about four bushels. Only the three hands that run the machine are furnished by the thresher; rest by the farmer, which, if threshing from the shock, will be about seventeen men, viz.: three pitchers in the field, six teamsters to haul rice, two band cutters, two stackers, two to fill sacks and move from the machine, and two to sew up sacks and pile them. Besides these there should be men and teams to take the rice to shelter or to mill. If the rice be taken from the stack, six men less are required. Some are now using what is called a self-feed attachment to the thresher. These attachments give very satisfactory results and reduce by three the number of men required.

Question—Rice mills, number and size?

Answer—Mills are being rapidly built in every part of the rice district; therefore accurate data cannot be given. In Acadia parish there are 19 mills of a capacity of 400-500 sacks per twelve hours; Calcasieu parish has 8 mills ranging from 100 to 800 sacks in twelve hours; Vermillion parish has 5 mills of 400-500 sacks per twelve hours each. I cannot give you further data.

Question—Cost of rice lands?

Answer—Varies according to location. In our immediate neighborhood they are higher than elsewhere. Some cannot be bought for $100 per acre. As one goes further out he can buy for fifty, forty, thirty, which are prices for all rice lands tributary to Crowley. In Vermillion and Calcasieu parishes, I believe lands can be bought from twenty-five to fifty dollars per acre, depending on distance from railroad, availability of water, character of land (level or rolling), etc.

Question—Fertilizers for rice?

Answer—Some have been using fertilizers on soil that has been cropped for several years, and all claim good results.

Answer—Rotation has been practiced but little. A change from rice to most any other crop would require a complete reversal of the conditions that obtain in the rice field. Where levees have been constructed drainage ditches must be dug, and vice versa, when one changes back to rice. It is therefore hardly probable that rotation will ever become a general practice.

Question—Are your lands giving way under constant culture of rice?

Asnwer—Differences of opinion exist. Some claim lands are deteriorating, while others claim no deterioration, and a few improvements from fertilizers held in the bayou waters used for flooding. However, I find that some who have grown rice the longest are resorting to the use of commercial fertilizers and claim that it gives them good returns for the money spent.

Question—Machines for building levees?

Answer—The Burton grader has proven the best for building levees in the field. With eight or ten mules will build two miles per day; cost about $75. There are many different implements for building levees, but none so complete as the above.

Question—Cost of digging canals?

Answer—There is a great variation, from 25 cents to $20 per rod; the latter price only for very small portions of a canal. The overage cost of a canal is about $1 per rod, aside from fluming.

Question—Charges per acre for water?

Answer—In times past the price was two sacks per acre. Now the universal price is one-fifth of the crop. By this arrangement the farmer and the canal men share alike the fortune or misfortune of the season.

Question—Are wells a success for irrigating rice?

Answer—Many wells have been put down to a depth of 175 to 300 feet to a bed of coarse sand and gravel. Most of these wells have been a success, though a few have met with failure. Some of the best single wells have irrigated as much as three hundred acres, while the average is about 160 acres. Some claim that the well water is superior to that of the bayou, but in this there is a conflict of opinions, some claiming that the water from the bayou carries in solution a large amount of fertilizer adapted to the growth of the rice. (This subject is discussed from analyses of the waters in another part of this bulletin.—Ed.)

The above questions were answered by several leading planters, but the replies were nearly similar to those given above. Hence only those given by Mr. Shoemaker are inserted, and it is believed that these will be of great value to those seeking investments in rice lands. Supplementary to the above, a few words may be given relative to fertilizers and rotation, both of which will some day be required upon the rice lands of Southwest Louisiana, not only to increase the yield of rice, but the latter especially to cleanse the fields already foul with obnoxious weeds.

Before discussing these subjects, anaylsis of the products of an acre of rice will throw some light upon the requirements of this plant for fertilizers.

COMPOSITION OF RICE AND ITS STRAW.

The proportion of rice grain to straw varies between wide limits. If the ground be very fertile, with an excess of nitrogenous manures, the amount of straw will be large; often excessive. A comparison of many experiments with rice conducted by this station, shows fluctuations from 1,582 pounds to 2,300 pounds of straw to each 1,000 pounds of threshed rough rice. In these experiments every effort was made to cut the rice at a uniform height, for it is almost needless here to remark that the proportion of straw to grain will still further vary if the rice be cut at unequal heights, leaving stubbles of varying length in the field. The average proportion of straw to rice with yields of about twelve sacks of 162 pounds each per acre, is about two to one.

Therefore a field yielding per acre twelve sacks of 162 pounds each, or 1,944 pounds of rough rice, will carry with it about 3,888 pounds of straw.

One hundred pounds of rough rice will contain 1.19 lbs. nitrogen, .321 lbs. phosphoric acid, and .16 lbs potash; and 100 pounds straw has .756 lbs. nitrogen, .26 lbs. phosphoric acid, and 42 lbs. potash. Therefore, a yield of twelve sacks of rice with its accompanying straw will require a total of:

	Nitrogen.	Phos. Acid.	Potash.
1,944 lbs. rough rice	23.13 lbs.	6.24 lbs.	3.11 lbs.
3,884 lbs. straw	29.49 lbs.	10.09 lbs.	16.31 lbs.
5,828 lbs. Total	52.62 lbs.	16.33 lbs.	19.42 lbs.

Compare this with an average crop of twenty bushels of wheat, with its accompanying straw, which gives:

	Nitrogen.	Phos. Acid.	Potash.
1,200 lbs. wheat	28.32 lbs.	10.68 lbs.	7.32 bls.
2,000 lbs. straw	12.00 lbs.	2.40 lbs.	10.20 lbs.
3,200 lbs. Total	40.32 lbs.	13.08 lbs.	17.52 lbs.

It will therefore be seen that one sack of rice, with its straw, will require 4.38 lbs. nitrogen, 1.36 lbs. phosphoric acid, and 1.62 lbs. potash, while two bushels of wheat with its straw requires 4.03 lbs. nitrogen, 1.30 lbs. phosphoric acid, and 1.75 lbs. potash.

These comparisons will show that a sack of rough rice, containing 162 pounds, carries with it and its straw, about the same quantity of fertilizing ingredients that two bushels of wheat weighing 120 pounds, with its straw, contains.

But since the yield of rice per acre is so much greater than that of wheat, the total draft upon the soil is about the same.

With these figures one can learn something of the fertilizing requirements of the rice plant, and it is important to note that its greatest draft is made upon the most costly of all fertilizing ingredients—nitrogen (over 50 pounds per acre with a yield of twelve sacks). The phosphoric acid and potash are not excessive, only about 16 pounds of former and 19 pounds of latter.

Cotton seed meal at the rate of 700 pounds per acre will supply the nitrogen and more than supply the phosphoric acid. It will only supply fourteen out of the nineteen pounds of potash required.

The above is a theoretical calculation of the amounts required by the crop. No allowance is made for the amount which can be supplied by the soil and the irrigation waters. But it should be remembered that good husbandry requires a maintenance of soil fertility, and to do so there must be restored to the land those elements which the crops annually remove, and rice is no exception to this rule.

IRRIGATION WATERS.

The principal sources of supply come from rivers, lakes, bayous and artesian wells. The analyses of these waters were made at the experiment station, and are herewith given in tabulated form. From these analyses the amount of plant food supplied by irrigation during one season can be determined pretty accurately, when the amount of water used per acre is known. It is assumed in Louisiana that each acre of rice during irrigation receives daily what is nearly equivalent to one-half inch rainfall, or about 13,500 gallons. If the period of irrigation extends over ninety days this would be equivalent to a rainfall of 45 inches. Deducting the average amount of rainfall for our summer months, which is not far from 20 inches, and there will be 25 inches, or 675,000 gallons, of irrigation water required for each acre of rice. This amount will weigh over 2,800 tons (5,625,000 pounds). By looking in table the amount of plant food supplied by irrigation during the entire season, can be calculated when the quantity of water applied is known.

ANALYSIS OF WATER APPLIED—POUNDS PER 1,000,000 WATER.

Localities.	Sources of Supply.	Solid Matter.	Ash.	Organic Matter.	Free Ammonia.	Albuminoids.	Nitrates.	Nitrites.	Lime (Cao).	Phosphoric Acid (P_2O_5).	Potash (K_2O).
Jennerette	Art. well, 700 feet	480.0	400.0	80.0	0.10	0.96	0.50	0.02	39.40	0.64	6.62
Mandeville	Art. well, 220 feet	179.4	150.4	29.0	0.09	0.06	0.2	trace	2.40	0.59	6.46
Lake Charles	Art. well, 500 feet	245.0	219.0	26.0	0.09	none	0.20	none	36.0	0.21	4.33
Gueydan	Bayou Queue De Tortue	545.0	440.6	103.0	0.18	0.28	1.387	trace	16.40	hv. tr.	3.68
Jennings	Mermentau river	348.0	299.0	49.0	0.082	0.3456	6.736	none	39.66	1.28	5.432
Fenton	Art. well	286.0	180.6	106.0	0.028	0.45	0.692	none	38.40	1.45	4.26
Covington	Art. well, 610 feet	161.6	133.0	28.6	0.08	none	0.04	trace	15.40	0.69	8.27
Ponchatoula	Art. well, 232 feet	237.0	198.0	39.0	trace	0.205	0.80	0.60	11.50	1.43	6.40
Ponchatoula	Art. well, 100 feet	512.6	450.0	62.6	1.98	0.20	1.00	0.40	2.0	10.24	11.64
Abita Springs	Art. well, 585 feet	184.0	154.0	30.0	.05	none	0.24	.06	0.7	0.74	4.80
Kenner	River	340.0	190.0	50.0	.005	.365	.15	.005	......	......	......
Frierson	Art. well	1154.0	711.0	443.0	8.55	0.36	0.504	none	34.00	0.853	trace
Belcher	Art. well	1050.0	878.0	172.0	0.073	1.14	0.368	none	30.00	0.64	0.84
Bon Amie	Art. well, 198 feet	253.9	200.4	53.5	0.17	0.24	0.17	none	5.0	......	......
Strader Station	Art. well	619.0	533.4	85.6	3.08	0.50	1.214	trace	43.30	2.90	3.91
Baton Rouge	Art. well, 758 feet	246.7	209.6	37.1	0.089	0.116	0.033	......	8.63	0.551	2.21
New Orleans	Rain water	......	......	......	0.190	0.99	0.500	......	......	......	......
Lake Charles	English bayou	116.6	85.0	31.6	0.041	0.067	1.93	0.25	6.20	0.64	4.20
Livingston	Denhem Springs	223.0	199.0	24.0	0.048	none	0.463	none	12.50	trace	......
Natchez, Miss.*	Art. well	......	......	......	0.120	0.036	0.000	0.00	......	......	......
Near Head Pearl River	Ozone Spring	......	......	......	0.020	0.056	0.080	0.00	......	......	......
Meridian, Miss.*	Reservoir	......	......	......	0.005	0.136	0.130	0.00	......	......	......

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* John Lewis Porter, New Orleans.

If we assume the rainfall to be 20 inches during the time the rice is under irrigation and that all the rainwater is retained on the field, this would represent 4,500,000 pounds of water per acre. From the foregoing analyses we make the following estimates by way of illustration of the fertilizing elements contained in these waters per acre irrigated:

	Nitrogen. lbs.	Phos. Acid. lbs.	Potash. lbs.
20 inches rain fall	7.75	.....	.....
25 inches Mississippi river water.........	6.67	.....	.....
Total on river lands	14.42	.....	.....
English bayou, Lake Charles, La..........	12.549	3.60	23.62
Total on land irrigated with this water,	20.299	3.60	23.62
Bayou Queue De Tortue, Gueydan........	9.061	.....	20.70
Total on land irrigated with this water,	16.811	.....	20.70
Artesian well, 500 feet, Lake Charles....	1.631	1.181	24.35
Total on land irrigated with this water,	9.381	1.181	24.35
Amount required for 12 sacks rice......	52.62	16.33	19.42

In the above analysis no account is taken of the sediment carried in suspension by the river waters. This, in the Mississippi river, according to analysis made by Humphrey and Abbott, constitute 1-1500 of the weight of the water. Therefore, the Mississippi river waters would furnish, besides the above, in solution, a sediment of 3,750 pounds to each acre irrigated. This sediment has goodly quantities of organic matter containing nitrogen, as well as some phosphates and potash, and unquestionably aids in maintaining the fertility of the soil.

It will be seen from these results that a considerable quantity of nitrogen, potash and some phosphoric acid is conveyed to the field in the irrigation water and the rainwater, but whether this is a valuable source of these elements is not determined, It has been claimed by some parties that the well and bayou water would practically supply the demands of the rice crop. It will readily be seen that this is impossible. Again from the above estimates we must subtract the estimate of the contents of the water that is drawn from the field just before harvest, which will be at least one-tenth or more of the entire amount of water supplied. We have no data as to the comparative contents of the irrigation water as it leaves the field. Here again comes in a number of variable factors that would complicate estimates and determinations. Through "chemical affinity" the soil is able to absorb a certain amount of salts from aqueous solution when the water filters through it. This power decreases as the point of saturation is approached, and also varies with the density of the solution from which the salt is being absorbed.

Again the roots of the plants exercise a selective power in absorbing salts, and we have no reason to believe rice is different in this respect from other plants. In taking up a given quantity of the salt, it may take up more or less water than contains that amount of the salt, according to the density of the solution. In very dilute solutions the plant may absborb the salt faster than it does the water in which the salt is dissolved. In dense solutions it dissolves the water faster than it does the salt. In short when plants are growing in water cultures that are very dilute they absorb the necessary salts and leave the solution more dilute. Plants growing in water cultures of considerable density absorb the water faster than the salt and leave the solution more dense. The irrigation water contains the nutritive elements referred to in very dilute form, and it may be that the chemical affinity of the soil and the selective power of the plant retain in the field a portion of these nutritive elements. On the other hand the soil may contain nutritive elements beyond the point of saturation of chemical affinity, and the water that is drawn away from the fields or leaks from the levees may be carrying away much more fertility than it carried to the field. Quite extensive research work on this subject would be necessary before one could speak with authority on the value of the fertilizing elements contained in the irrigation water.

FERTILIZERS FOR RICE.

NITROGEN.—All cultivated crops utilize the nitrogen required in the form of nitrates and these are abundantly formed in every fertile soil by the process of nitrification, the work of microscopic organisms. Both the organisms involved and the conditions under which they perform the work of the conversion of the organic nitrogen into nitrates, have been frequently and thoroughly studied.

One of these conditions requires drainage or removal of excessive water, which destroys or drowns the microbes.

Therefore the process of nitrification cannot take place in an inundated field and the application of fertilizers containing organic nitrogen, such as cotton seed meal, tankage, dried blood, stable manure, etc., cannot be converted into available nitrates in a flooded rice field.

If applied, the fields should be left dry and in good tilth, sufficiently long to promote nitrification enough to supply the prospective wants of the future crop. How long a time should be required for this, is not yet definitely decided. Perhaps a thorough preparation of the soil with the application and thorough incorporation of such fertilizers as cotton seed meal, dried blood, stable manure, etc., early in January, with occasional subsequent cultivation with disc or other harrows, in case the soil becomes compact, until the rice is planted, would accomplish their conversion into nitrates. During this time the fields should be well drained.

In some instances attention has been called to fields that have been in rice for a number of years where the stem and leaf growth has gradually become more vigorous, as if the supply of nitrogen was becoming more abundant rather than being depleted. The probable explanation of this is as follows: For centuries the soil was water soaked and became very compact. Nitrification had been reduced to a minimum degree. When the soil was plowed and reclaimed from the prairie, the surface began to assume a condition of tilth, air penetrating it as deeply as plowed, and nitrification has been bringing the locked-up nitrogen into an available form. The tillage and drainage has improvevd the natural condition of the soil. This effect, however, must soon cease to be exemplified.

It must be remembered that nitrogenous fertilizers produce rank growth of stem and leaves, and where there is already trouble from rice blowing down, these fertilizers should be used with caution. Probably more nitrogenous fertilizers may be used with Japan rice than with Honduras, since the latter is prone to produce larger and taller stems naturally.

It can be said in general that land that produces sufficiently large straw does not need nitrogenous fertilizer. If the straw is small and weak it needs nitrogenous fertilizer.

When the straw and heads are already well proportioned and fertilizer is applied, nitrogenous fertilizer should always be added with phosphate fertilizers. Where dry culture is practiced between rice crops, the supply of nitrogen may be supplied by cultivating cow peas, or other leguminous crops. However, good drainage between the time of harvest and the followng flooding of the next crop will materially augment the amount of available nitrogen, by allowing nitrification to take place.

PHOSPHORIC ACID.—This ingredient, in which many of our soils are deficient, and whch exists in very small quantities in the irrigation waters, as will be seen from reference to the table of analysis, cannot be resupplied to the soil in any way except in the form of commercial fertilizer. There is none in the air and practically none in the water. Phosphoric acid is necessary, especially to fill out the grain. It also helps to make a stronger, more stocky stalk. Nearly all of our rice lands could be profitably fertilized with a good phosphoric acid fertilizer. Where rice produces a fairly good or even rank growth of stalks and fails to mature seed, it is no doubt in nearly all cases due to a deficency of available phosphoric acid. The available phosphate has been exhausted in supplying the requirements of the excessive nitrogen component and when time comes for the grain to mature this element is lacking and so no gran is produced. Such results are most frequent in new land, and diminish as the excess of nitrogen is used up.

It may be said in general that wherever the heads fail to develop as heavy grain as should be, it indicates a deficiency of phosphorc acid and this element should be supplied in commercial form. Acid phosphate, ground bone, dissolved bone, are some of the most common forms of commercial fertilizers rich in phosphoric acid.

POTASH.—It is probable that we can almost overlook this element in our fertilizers for rice in many localities, while it may be beneficial to some extent in other soils. By reference to the tables given it will be seen that the waters of the bayous and wells are fairly rich in potash, indicating that it has been dissolved out of the soil over which the water has passed. Most of our soil is rich enough in potash, and it is safe to begin the use of commercial fertilizers without considering the potash component.

Another suggestion as to a probably successful mode of applying fertilizers, particularly to those fields from which there is no escape of the applied water. Nitrate of soda is a commercial form of fertilizer, containing fifteen to sixteen per cent. nitrogen. It is extremely soluble in water, and in form readily assimilable by all growing plants. This commercial salt might be applied in small quantities continuously to the water at the flood gate. It would soon diffuse itself through the entire mass of water and go with the latter to every part of the field. High grade acid phosphates, containing its phosphoric acid in water soluble form, and some form of the German phosphate salts, also soluble in water, might both be applied with nitrate of soda. On a small area, the above suggestion is well worthy of a trial, particularly in Southwest Louisiana, where the impervious subsoil would prevent leaching, and no irrigation waters are permitted to waste.

Stable Manure.—Some parties have applied stable manure to rice fields in heavy applications and caused the rice to produce an excessive growth of stem and it would fall down and produce no rice. Instances of this kind are evidences of bad judgment. Stable manure is rich in nitrogenous matter, and should not be applied too heavily. A few loads per acre is sufficient, and it is well to add some acid phosphate with this. Where mounds have been leveled down, stable manure is a most valuable fertilizer to put on the spots that would otherwise remain unproductive. All the stable manure on the rice farms can be profitably used if used judiciously.

ROTATION OF CROPS.

It is evident that since we are removing more of the fertility of the soil in each crop than is being replaced, continuous cultivation of our fields must eventually become unremunerative. No soil can stand such drain without detriment to its fertility ultimately. Aside from this consideration, the increasing foulness of our fields suggests a rotation of crops for the destruction of noxious plants. The irrigation waters are scattering the seeds of these plants over every farm. Red rice is a constant enemy to the production of prime quality of grain. Again a rotation with dry crops would ameliorate the mechanical condition of the soils, and increase by nitrification the available nitrates therein. If a leguminous crop, like the cow pea, could be made a part of the rotation, there would be added to the soil, by turning it in, at least 100 pounds of nitrogen per acre. By applying to this crop acid phosphate and potash, at the time of planting, it would be largely increased in quantity and quality, and by turning in the entire crop greatly add to the fertility of the soil. Such a practice might present a solution to the difficult problem of how to fertilize rice.

In Java the crop rotation practiced is, first, sugar cane; second, leguminous crop; third, rice; fourth, leguminous crip; fifth, rice; making a three years' course with two crops of rice, two of legumes and one of sugar.

The rainfall there furnishes about 9 pounds of nitrogen annually per acre. The irrigation water for the two crops of rice is applied at rates of 18,000 gallons per day for 120 days for each, containing in the alluvium deposited, one per cent. soluble potash and two-tenths of each phosphoric acid and nitrogen. Prinsen Gerligs has found that the fertilizing ingredients of irrigation water varied within wide limits, being very great after heavy rains in the country supplying them. Enough phosphoric acid and potash for the two crops of rice and sugar cane are supplied in the irrigation waters, but it was necessary to grow two crops of legumes in order to supply the deficient nitrogen. Several leguminous plants are popular in Java, among others, our common beans, peanuts, and soja beans.

A rotation involving a hoed crop like sugar cane and a leguminous crop like cow peas, with rice, would not only aid in retaining the fertility of the soil, but in extirpating the obnoxious weeds.

The major portion of the rice section in the prairie region does not produce good corn, cotton and sugar cane. But we believe this is mainly due to the mechanical condition of the soil and lack of drainage, and the productiveness will increase from year to year under proper management. Small patches of cane and corn in garden spots are often seen as fine as can be produced anywhere. It can hardly be doubted that the proper study and attention would develop crops well suited to the system of rotation.

The large tracts of land owned by corporations and worked by tenants who shift from one community to another present a greater problem in this regard than does the case where the man owns and cultivates his own land.

With the sugar houses turning out large quantities of cheap molasses which are available as carbohydrates, the cotton seed furnishing the meal so rich in protein, the rice mills with their valuable by-products, rice bran and polish. with the possibilities of hay production on almost every farm, it is hoped that the rice planters may be induced to add stock raising to rice farming, which will help to bring about rotation, and add to the income a source of profit from the production of fat beeves for the market, home-raised pork, and butter and milk to at least supply the domestic demand.

STACKING RICE.

Of late there has been considerable discussion in regard to the advisability of stacking rice before threshing. This subject was brefly referred to in another section. The advantage in stacking comes from protection from the weather before threshing and from stack curing. If properly done the fermentation that takes place during the stack curing improves the milling quality of the rice, but if improperly done it may injure the grain from stack burning. We produce here two letters from practical rice growers which present a very good discussion as given in current rice literature:

"If the rice is dry and the weather favorable and one is unable to get hands or a threshing machine for some time, he had better stack. When a machine can be secured, thresh out of the shock without delay.

If there are no good places for stacking on the ground in the field, it will pay to use platforms to build stacks on. Use 6x8-inch sills and 2-inch planks for the floor. I would not advise the use of covers for well built stacks. If covers are used, they should be made of heavy, oiled or tarred tarpaulin.

The main point in stacking rice is to keep the center full. If you wish to build a medium sized stack, make it oval. I would not make it too small, say from fifty to seventy-five shocks.

The small shocks recommended on page one of the August Rice Journal will do for wet or unsettled weather. It takes less time for a small stack to dry, and the rice is not so liable to heat. From the first to the fifteenth of October is the best time to put rice into large stacks, if large ones are used. If small stacks are used, put the rice into them as soon as the rice is harvested.

Two teams with one pitcher in the field and one stacker can handle from ten to fifteen acres per day. At the ruling wages, the cost would be $9.50 per day. The cost for 100 acres would be from $60 to $95. I would say that it would cost from $50 to $75 per 100 acres to haul rice from the shock to the thresher, if the thresher does good work with no delays. The farmer who owns a threshing machine and saves his own grain first is the "lucky man." —*W. D. Spencer, in Rice Journal and Gulf Coast Farmer.*

"I believe it will always pay to stack rice. I do not think platforms under stacks pay in this territory. I have had good success stacking on the ground. You can generally find high ground near enough to stack on in this country.

When a stack is not finished at night and there is danger of rain, a large canvas, like a separator tarpaulin, is fine to throw over the stack. Under no other circumstances is a cover needed. If a stacker knows his business, his stacks need no cover, since they can be finished with rice itself so as to leave only two sheaves exposed to the weather.

Keep the center of the stack full, at least four feet above the outside. Do not tread near the outside of a stack. For this country I think round stacks that will hold, say, one hundred bags, are the best. Set four of them so they can be tabled at one setting of the machine.

I do not think the small stacks mentioned are as good as large stacks; but when for any reason a man cannot put up large stacks, they are very good substitutes. When a man has to wait for a thresher, he should be stacking right along. The best time to begin is just as soon as the rice is dry enough to stack, which will be as soon as the natural juices and moisture are out of the straw—entirely out, not when the straw is just wilted.

It will cost about $95 per 100 acres to stack rice where everything is convenient. If it must be hauled some distance, it will cost more, say $120 per 100 acres. On the average I think it will cost about $100 per 100 acres to haul rice from the shock to the thresher.

A man should go over the field after every wind storm and put on the caps that have blown off. Where some shocks have settled crooked or have broken down, they should be doubled into small stacks, as shocks once broken can never be reset to stand."—*M. Romain, in Rice Journal and Gulf Coast Farmer.*

MEMORANDA OF WEIGHTS, MEASURES, ETC.

As the rice comes from the thresher it is put in sacks, which hold about 4 bushels.

A sack of rough rice weighs from 160 to 190 pounds, depending largely upon the quality of grains.

A bushel of rice weighs 44 pounds.

A barrel of rice is estimated at 162 pounds.

An acre yields from 6 to 12 sacks, and in exceptional cases double this yield is secured.

A sack of rough rice will mill about 100 pounds of clean rice.

A pocket of rice is 100 pounds of clean rice, and is the form in which the product is almost exclusively sent to market.

Price of rough rice ranges from $1.50 to $4.75 per bag, according to amount of red rice, weed seeds, quality of grain, etc.

A harvester will cut from 6 to 10 acres of rice per day.

A threshing machine will thresh from 300 to 500 sacks of rice per day.

Cost of threshing is about 10 cents per sack.

SOURCE OF NITROGEN AS FOOD FOR THE RICE PLANT.

Some experiments were made by Mr. Dodson and Mr. Glenk for the purpose of determining whether the rice got any of its nitrogen in a form other than as nitrates, and also to determine whether nitrification was retarded or stopped by flooding the fields.

For the determination of the first point, a number of artificial soils were prepared, in which the nitrogen was supplied in different forms.

Pots were filled with pure white sand, which had been washed with distilled water and sterilized. This served as a matrix, and the rice seeds were planted in the sand and kept moist till germination and growth to the proper height for flooding. The jars were then kept full of the nutritive fluid. After the plants were a few inches high they were left in the garden, exposed to normal sun and rain. As the pots became much warmer than the sun after a couple of weeks the pots were imbedded in the soil, and provision made to exclude soil or soil water from contaminating the cultures. No protection from dust was provided. Nitrogen was furnished as NO_2, NO_3, NH_3 humus, and as soil. The pot containing NH_3 made quite a vigorous growth, indicating the utilization of nitrogen in this form.

Numerous tests were made for nitrites and nitrates in the soil of irrigated rice fields. It was found that toward the close of the irrigation season practically no nitrite was left in the soil, indicating that the first step in the process of nitrification had been arrested.

PART II.

RICE WEEDS IN LOUISIANA.

The rice fields of Louisiana offer conditions peculiarly favorable for the growth and dissemination of weeds that normally inhabit wet or flooded soils. Quite a number of weeds increase with such rapidity and grow so luxuriantly in the rice that expensive methods of getting rid of them are often imperative. All flowering plants that have a harmful effect upon the cultivation, development, harvesting or marketing of the rice crop will be designated as rice weeds. Besides what are commonly called weeds, grasses, sedges, and even red rice, would come under this head. In this article it is our purpose to discuss the weeds that have proven to be most menacing to the rice crop, with such information as has been obtained regarding their reproduction, dissemination, and general life habits, and to point out some of the advantages of various methods to be adopted for their extermination. While we shall have occasion to refer to the weed seeds at the rice mills, the weed question must be solved primarily by the rice grower, and the most of the discussion will be from the standpoint of a planter.

It is self-evident that a crop with weeds in it produces a less quantity and of an inferior grade to what it would without the weeds.

The weed takes up valuable fertilizing elements that rightfully belong to the rice plant, occupies a space that should be occupied by a rice plant, and the shade produced interferes with the fullest development of the rice. The presence of weed seeds in the rice causes more trouble between the producer and the buyer than most any other one source of contention. It is hard for the miller to tell how much is going to be lost in cleaning the rice of seeds, or how much will remain with the grain when it comes out as a finished product. It is simply a matter of self protection that he should cut down the price very materially on account of the presence of any considerable quantity of seed from various weeds.

Besides these losses the efforts directed toward the destruction of weeds in the rice fields in Louisiana amounts to a great many thousand dollars annually.

The planter should not only be conversant with the habits of the weeds already infesting his rice fields, so as to adapt his methods of dealing with them to best suit the various conditions that obtain in different years, but he should know the most baneful weeds that are liable to invade his territory from without, so that the new enemies may be recognized and measures adopted to secure their extermination before they have become widely disseminated.

It is not infrequent that the knowledge of the life habits of a weed will enable one to successfully hold it in check at a minimum of expense, whereas, without such knowledge, efforts at extermination, being blindly directed, will be all but useless.

It goes without saying, that weeds are more prolific and hardier than cultivated plants. It is chiefly their persistency that renders them noxious.

The production of a large number of seeds, the adaptation for sure and wide dispersion of same, the preservation of the vitality of the seed under adverse circumstances, the ability of the plant to withstand unfavorable conditions as to light, warmth and moisture, the undesirability of the plant as food for animals, their freedom from fatal fungus diseases and insect enemies, are the principal characters that enable our worst weeds to obtain such predominance. Fortunately few individuals possess all these characteristics. As it is not practically possible to prevent all weeds from maturing seeds, nor to kill all seeds that mature, the planter must direct his efforts along both lines of extermination. A general understanding of the life habits of weeds, supplemented by close observation, will enable him to direct his efforts in a most effectual manner.

DISSEMINATION OF WEED SEEDS.

(1) BY WATER CURRENTS.

Water is a very important agent in distributing seeds, and especiallly is this true in the rice sections of the State. Some of the worst and most widely distributed rice weeds are primarily dependent upon water currents for their distribution. The seeds of the "curly indigo" (*Aeschynomene Virginica*) are always accompanied by a portion of the seed pod, which acts as a float, carrying them on top of the water, and as the pod breaks into as many segments as there are seeds, wide dispersion is assured. The seed of the "tadpole grass" (*Rhynchospora corniculata*) has a large, long spear which prevents it from sinking till it becomes thoroughly soaked. The "alligator head" (*Diodia teres*) is covered with fine hairs, which are repellant to water and prevent the seed from beceoming wet for a considerable time, and the air bubble which is consequently formed about the seed will cause it to float on the surface of the water.

One seed from each pod of the "turtle back" is encased in a little boat, as it were, resembling a turtle shell, which may float the seed to remote parts of the fields. The very small seeds, like those of the seed box, sea weed, etc., and some grasses, are so small that a gentle current of water will carry them almost indefinitely, unless some obstruction stops them. It is only when the water becomes still and the seeds thoroughly soaked that they sink to the bottom.

Few of them germinate till the field is drained, and consequently do not develop till after the harvest, or till the following year. Some of them, however, may be drifted against the levees, and a slight recession of the water leaves the seeds in condition favorable to immediate germination.

Fragments of stems or seed pods may assist to secure dissemination, by causing the seeds to float in the water currents. It will be seen that the rice fields offer conditions for the wide distribution of the seeds possessed of the characters referred to. The enormous increase of weeds in the fields the second year it is devoted to rice culture is thus partially explained.

Dispersion may not only occur during the time the rice is flooded, but even to a greater extent during the fall and winter from the heavy rains that temporarily flood the fields.

SEEDS INTRODUCED IN RIVER WATER.

The alluvial lands of the State devoted to rice culture are apt to develop a great variety as well as a great number of weeds not previously established there. During the low water of summer and fall, the river banks become densely populated at many places with thrifty weeds, and seeds mature and fall to the ground in great numbers. The following spring, when heavy rains come, the river gradually climbs the banks, and the lapping waves sweep seeds and fragments of weeds into the current, where some of them may be carried to considerable distances. Local freshets wash many seeds from branches and bayous into the river. The river is frequently on the rise, and therefore carrying its greatest burden of seeds when the time arrives to begin pumping water to cover the rice fields in the early spring. When the water carrying the seeds is passed from the canals into the rice plots, the current being very greatly checked, its carrying powers greatly diminished, the seeds are dropped on the soil and at some time find conditions favorable for development. The number of seeds carried by the river water is very great and there is no doubt the fields may become badly infected from this source with a great variety of weeds; at the same time much is attributed to the water that is really traceable to the oversight of the planter in allowing weeds to mature seeds within the limits of his fields.

Estimates were made at different times of the number and kinds of weed seeds carried by the Mississippi. Water taken from near the surface of the river has been found to contain vast numbers of seeds, amounting to a dozen or more per pint of water. At other times, we have measured and strained several gallons without obtaining a single seed. Water from deeper sampling also contained considerable quantity of weed seeds.

The planters of Southwest Louisiana obtain water for flooding from the bayous and deep wells. Of course in the well water there are no seeds. The bayous being very sluggish, have very little carrying power, and the seeds that find their way into these streams soon sink to the bottom, or floating, are drifted to the shore. Therefore, the imported weeds of this section are not as numerous as in the alluvial lands. There is at present very little money spent in weeding the rice in this section, but several bad weeds have become widely distributed and only the strictest vigilance will prevent them becoming a very great source of annoyance. Some dangerous species have found a foothold along the main canals, from which they may become generally distributed,, unless preventive measures are adopted. In some limited sections the weeds are already quite annoying, as will be seen from the particular species discussed in detail later on.

ADVANTAGES OF SYPHONING WATER OVER THE LEVEE FROM A RESERVOIR.

When the water is pumped from the river to a reservoir and then syphoned over the levee, many seeds will settle to the bottom of the reservoir. The larger the reservoir, and the less current in it, the greater number of seeds deposited in the bottom.

LOCAL SOURCES OF WEEDS.

Many planters who do not give close personal supervision to their plantations, and some who are not diligent in their fight against noxious weeds, pay little or no attention to the banks of ditches or canals that lead the water to the fields, or to areas not actually occupied by the rice. Elevated places in the fields that are not easily flooded are allowed to grow up in weeds and seeds become widely scattered from such places. One of the illustrations given elsewhere was made from a photograph taken in a field cultivated by a gentleman who is considered one of the best planters in the State. It is known to the writer that this gentleman spent a large sum of money for weeding rice, and that he expects to put this same field in rice next year.

Such areas constitute islands, slightly elevated above the surface of flood water, forming ideal conditions for the development of many weeds. Ditch banks are often allowed to grow up in weeds unmolested, and scatter their seeds in the ditches, to be washed wherever the currents may take them.

These areas are generally burned off at some time before the next planting season, with the idea that all the seeds will be destroyed. The efficiency of the method is considered under the head of burning stubble.

(2) ANIMALS AS DISTRIBUTERS OF SEEDS.

Too many planters fail to appreciate the importance of animals as distributers of weed seeds. While many weeds are not eaten by cattle, most of the grasses are, and at times also the coffee weed, indigo, and others, and the seeds pass through the digestive system without having the vitality of the seed impaired. Red rice is very apt to pass through undigested unless the grains are crushed. Seeds eaten in the uncultivated portions of the fields may be dropped in the level cultivated areas where special effort is made to exterminate weeds of all kinds.

Rice straw often contains many seeds that are not crushed by the mastication of the animal, and the seeds thus become scattered over the fields where the animal is pasturing, or being worked. While the seeds scattered in this way may not be very abundant in any one year, a number of centers of distribution are established where seeds may be matured in considerable numbers the next year, and many centers of distribution established. When cattle are allowed to run on the rice fields, they should not be allowed to run alternately on new land and old, as they will certainly carry many weed seeds and red rice to the new fields.

To a limited extent, cattle may scatter seeds by tramping during muddy weather. Seeds in the mud, clinging to their feet, may be carried to places where no weeds have matured.

Birds may become the distributers of the smaller seeds. Owing to the deficiency of gravel in the rice districts the food of the birds is not perfectly ground, and some of the smaller hard seeds may pass through the digestive system without injury. Such seeds have been found in the excrement of birds that roost in the fields.

Fragments of stems, often carrying seeds, collected by birds, for nest building, are often dropped in the fields, and a focus of infection of a bad weed is established.

(3) WIND AS A DISTRIBUTING AGENT OF WEED SEEDS.

Among the grasses several species produce seeds that are provided with a tuft of hairs which render the seed bouyant enough to float in the air in gentle currents. Such seeds may be very widely distributed during strong winds.

Some of our worst grasses produce heads that are very much after the order of "tumble grasses," the heads being of slender, diffusely branched form, very light, and when such heads are broken from the stem the wind may roll them over the fields, scattering the seeds everywhere they go. There are nearly always some places about the fields where such grasses are allowed to mature seeds, and after the stubble is burned off they go rolling over the fields, carried by every wind. Bull grass (*Panicum agrostidiforme*) scatters considerably in this way.

(4) THRESHING MACHINES AS DISTRIBUTERS OF WEED SEEDS.

In threshing a weedy crop weed seeds find lodgment in many places about the machine and in the rice left in the various receptacles. In moving the machine these seeds are scattered along the fields and roadsides, or deposited where the next threshing occurs. As the roadsides are frequently supplied with an abundance of water from the leaking levees, favorable conditions are offered for the development of the weeds that we most dread. As it is not the business of any one in particular to destroy these weeds along public highways, we have constantly increasing centers of distribution for weeds of the worst character, and they rapidly spread into the adjoining fields. These remarks are more applicable to the conditions existing in Southwest Louisiana than on the river lands, because the roads in the river section are along the river levees, and occupy the highest part of the plantation, and because the machines are not moved from place to place as they are in the Southwest.

After a weedy crop is threshed, the machine should be thoroughly swept and cleaned before it is moved to another field. This precaution should be especially observed against red rice. It can almost be stated, as a rule, that the weeds that predominate in the flooded places along the road sides are noxious weeds, and will grow in the rice fields if they become planted there.

DESTRUCTION OF WEEDS.

There is no easy and sure way to insure the destruction of the weed crop, or to prevent the seeds from getting on our ground, but a great deal may be done to hold them within reasonable bounds. We shall note the methods adopted by various planters for fighting weeds.

BURNING STUBBLE.

Early Burning.—It is a custom with some planters to burn off the stubble as soon after the harvest as possible. A mowing machine is run over the ground, cutting everything as low as possible. After a few days, fire is introduced and allowed to take its course. This method not only kills a great portion of the seeds that may have ripened, but it also kills a great many roots and prevents further development. The bare soil will then germinate many seeds that would otherwise have remained dormant in the soil till the following spring. These plants are not likely to mature fruit before frost, when they are killed.

A serious objection to the method is that it injures the land in many ways. It leaves the surface exposed to the hot sunshine during the late summer and fall, which not only bakes the soil, and has a detrimental effect upon its physical condition, but it interferes with the normal process of nitrification. It is well known that shade accelerates, and sunshine retards, the development of the organisms that play so important a part in maintaining the supply of available food. This process is reduced to a minimum or probably stopped altogether while the rice field is flooded, and as the winter temperature reduces the activity of such organisms to a minimum, the only time left for the operation of nature's method of maintaining fertility is from the time the flood water is drawn off till the earth becomes too cool for the active growth of soil bacteria. If, now, this period of recuperation be interfered with by burning, as above indicated, the soil will become depleted much more rapidly.

Another objection to leaving the soil bare is that leeching of the soluble elements will take place to a much greater extent. Where the soil can be plowed after burning, and sown to oats or other winter growing crops, the method is not objectionable. In fact, it is commended where it can be carried out.

Late Burning.—A great many, probably the large majority of the river planters, allow the fields to go unmolested after harvest till late in the fall. A dry time is selected and fire is set to the field of grass, weeds and stubble. Great quantities of seeds are destroyed. This burning is especially destructive to red rice. Grains that are on the stalk, or lying on the top of the soil, are mostly killed by the heat or burned completely.

In the prairie, stubble burning is not so common, the harvest being later, there is not so much aftergrowth to be dealt with, and the stubble can readily be plowed under.

However, there are some objections to ever allowing weeds to mature seeds, if it can be economically prevented. The most of our bad weeds scatter some of their seeds almost as soon as they are ripe, and great quantities of them are shattered before the late burning of the stubble. Some of these seeds will find protection from the fire. If the soil is dry, it cracks open, and some seeds find lodgment in the cracks. If it is rainy, they are covered with soil sufficinet to protect them in many instances. Mice and crayfish here and there cover the seeds with the soil taken from their holes. Where the fields are pastured, as they generally are more or less, an immense number of seeds may be trampled into the ground a sufficient distance to protect them from any burning that may follow.

Birds of various kinds scratching in the fields may cover a good number of seeds. Where the soil is rough, seeds will bounce under clods or rough places and be protected from the fire. There are in all fields spots here and there where the fire does not burn well, leaving seeds uninjured, and subsequently during heavy or continued rains these seeds may become scattered widely. The writer has found that in seemingly well burned fields there are clumps of straw or other vegetable matter half decomposed, which have held an excess of moisture, which have not been burned. In these masses it is quite frequent that many seeds may be preserved. The canals are especially apt to be moist or wet in the bottoms, and the fire does not kill all the seeds there. In making examinations of fields that had been burned about as well as they are ever burned, seeds were repeatedly found in all the conditions stated. Repeatedly we selected places where weeds were known to have grown, and searched the surface soil for seeds. In all instances we were able to find seeds that had not been heated sufficiently to impair germination.

Since the coffee weed, or indigo (*Sesban macrocarpa*), is the most widely distributed of the rice weeds, as well as one of the worst, and since it grows to sufficient size to leave a recognizable stump after the stubble has been burned, and since it has large seeds that are easily recognizable, special observations were made on the efficiency of burning for the destruction of these seeds. In going over the fields and selecting these burnt stumps at random, and making a close examination for seeds in the vicinity of the stumps, we were able to find in every instance a few seeds that were not killed by the fire. It may therefore be said to be practically impossible to destroy all the seeds by burning the stubble. We cannot, therefore, rely upon this method alone. The planters of Southwest Louisiana who allow seeds to mature, thinking burning will destroy all the weed seeds, will sooner or later find hand weeding a necessity, as does the river planter today. This method, however, of burning is to be commended when the conditions are such as to prevent early plowing. The writer simply wants to emphasize the fact that all seeds cannot be killed in this manner.

PLOWING FOR THE DESTRUCTION OF WEEDS.

Some planters burn the stubble in the fall and plow very early in the spring, so as to cover weed seeds and red rice, with the hope of securing the early germination of a good portion of the weeds and red rice, before time to plant the crop. Then just before sowing the seed the land is cultivated to destroy all the germinated plants. If, however, he waits to secure the best results in the destruction of the weeds, he loses by getting his crop in later. It is the desire of the planter to market his crop as early as possible, so as to get the benefit of the higher prices that generally prevail early in the season. If, therefore, he is delayed to accomplish the destruction of the weeds, he loses the benefit of the early price.

DISCONTINUING CULTIVATION FOR THE DESTRUCTION OF WEEDS.

In the alluvial lands, as a rule, only two or three successive crops of rice are raised. The soil is then devoted to clean culture or allowed to grow up in weeds for one or two years. After being devoted to two crops of rice the land becomes so badly infested with water weeds and red rice that a third crop is hardly profitable. If now the land be drained and the dry land weeds be allowed to grow, they will almost exterminate the weeds that require wet environments. Of course vast numbers of seeds are matured by these weeds, but they have shaded and crowded the water weeds almost to the point of extermination, and now if the soil be again devoted to rice, the dry land weeds can be held in check by the flooding. In short, weeds are used to fight weeds.

While it looks like extravagance in the extreme to allow such land, rich as it is, to grow up in weeds, some of the best planters advocate this practice. They say the land regains fertility, and the finest rice crop is the first crop after it has been allowed to grow up in weeds. A word of explanation of the increased productiveness of the soil may not be out of place here. Generally the land develops a heavy crop of coffee weed, or indigo (*Sesban*). This plant, being a member of the leguminous family, has the power to appropriate the nitrogen of the air, as is evidenced by the numerous tubercles often found on the roots, resembling those of the cow pea. They therefore add considerable nitrogen to the soil. Again, as the soil has been drained and shaded during the summer months, normal nitrification in the soil has reached its maximum. If now the land be devoted to rice, flooding stops the process of nitrification for more than half the summer, with the result that the crop the following year finds a less quantity of plant food available. It is very doubtful if the land gains as much by growing a crop of weeds as it would by being devoted to a crop of corn and cow peas.

In Southwest Louisiana, a great deal of land is planted in rice continuously for a number of years, as the weeds can be better controlled by proper flooding. In this section the land is generally devoted to rice till the red rice becomes so abundant that white rice cannot be longer made profitable.

Land is then temporarily abandoned on account of the red rice. No doubt planting the land to cow peas or velvet beans would be vastly more profitable than allowing the land to lie idle for a period.

FLOODING FOR THE DESTRUCTION OF WEEDS.

While the rice plant requires an abundant and a continuous supply of water to attain the best growth, continuous flooding is not essential, and one of the prime objects in flooding the rice as we do is to suppress the weeds. Few of the weeds will germinate and grow in water, and most of them are killed by continued flooding, if they are completely covered. Therefore weeds of slow germination and slow growth give little troble in the rice fields. The worst weeds germinate rather quickly, and unless the field can be flooded just at the proper time they are enabled to get the bud at the end of the stem above the water, and they are then established. Excessively deep flooding to reach them will then probably do more harm to the rice than it does good in the destruction of weeds.

HAND WEEDING.

In the alluvial land it is the general rule to go over the fields two or three times during the growth of the crop to pull out all weeds by hand. Where the weeds are especially bad, this becomes a tedious and expensive labor. In extreme cases the cost may exceed six dollars per acre, for the season, but in most cases it is much less than that. The average cost is probably between a dollar and a half and two dollars per acre for hand weeding. The cost to the planter of a crop of weeds is not limited to the amount he has to pay to have them pulled out. They have interfered with the growth of the rice up to the time they are removed, and where the weeds are very bad the space occupied by the piles of pulled weeds is quite considerable.

Some planters claim that the pulling of the weeds serves as a cultivation to the rice, and that after the weeding the rice begins at once to show a more vigorous growth. How much of the increased growth is due to the breaking of the surface soil from pulling the weeds, and how much to the fact that the competitors for plant food have been removed, is hard to say, but the writer is inclined to think the stirring of the soil by pulling the weeds has little to do with the increased growth of the rice.

Hand weeding has not yet become necessary to any considerable extent in Southwest Louisiana. The best planters very wisely go over the fields and pull out such weeds as are discernible, of the varieties that are there recognized as bad weeds.

However, unless greater care is taken to exterminate some weeds that are now getting a good foothold there, hand weeding may become a necessity.

The annual expenditure for the eradication of weeds can be materially reduced if the planters will but give the matter their careful consideration. Hand weeding to a certain extent will probably always be necessary, but the amount of it can be reduced by giving more attention to the prevention of the maturing of seeds on the plantation.

MOWING YOUNG RICE AND WEEDS AND THEN FLOODING TO DESTROY WEEDS.

Sometimes when the rice is small and is not far enough in advance of the weeds to permit of flooding so as to cover the weeds, the entire field is mowed, just low enough to not cut off the buds of the rice stalks. Most of the weeds, except the grasses, bear the bud on the summit of the stem, while that of the rice is folded in the leaf, and it is considerably below the summit of the blade, and it is therefore not difficult to cut the bud of the weeds without cutting the bud of the rice. The weeds are retarded in their growth more than the rice, which shoots up new leaves from the uninjured bud, and the field can soon be flooded so as to cover the weeds and kill most of them without injury to the rice. This method, of course, is not effectual with red rice and the grasses.

PASTURING FOR THE DESTRUCTION OF WEEDS.

Pasturing land will diminish the number of weeds if pastured close enough. Many of the weeds that the cattle will not eat will be trampled to death. Keeping the land dry tends to diminish the water weeds. It is suggested that better results would be obtained if the land was plowed some time during the summer and stock taken off so the soil would remain loose, so as to force germination of as many seeds as possible, that they may be destroyed later.

WEEDS DESTROYED BY BIRDS.

The vast throngs of black birds, and other species, that frequent the rice fields are not altogether a nuisance. While they destroy a great deal of rice, they live after the harvest almost entirely upon what they pick up from the fields, and thus destroy a great number of weed seeds and red rice.

RICE WEEDS AND THEIR HABITS.

While it is not possible, nor desirable, to give here all the weeds found in the rice fields, it may be helpful to give the names and the characters of the worst of them. In some instances a weed is known by different names in different parts of the State, and we have attempted to get all the names applied to each plant. Of course there can be but one scientific name, which is given after the common names, and written in italics. In a few instances no common name exists.

RED RICE.

According to the explanation given of the use of the term weed, few will deny red rice the privilege of standing at the head of the list. It is the most widely distributed and most difficult to deal with of all the weeds. Few if any rice fields that have been cultivated one or more years are absolutely free from this pest. It steals into the fields ere we are aware, and sticks there with a persistency that is almost incredible. At one time many planters thought it spontaneous, or that it resulted from the shattered white rice remaining on the ground all winter and germinating the following year. This latter idea is still entertained by some planters, but the majority of the more observant have abandoned it. There was a time when the northern wheat grower thought the chess in the wheat was produced by the wheat plants that were injured during the winter. The origin and rapid increase of the chess was apparently as mysterious as that of the red rice. The two cases thus far are exactly comparable. Few if any intelligent wheat growers now hold to this idea. While the wheat and the chess are botanicallly more remote than are the white and the red rice, the red rice is a distinct form, and the idea that it comes from the white rice that has remained in the field over winter is rapidly being abandoned. This matter was thoroughly investigated by the Experiment Station and the results published in Bulletin No. 50, 1898.

The red rice grows in China and Japan as well as America. The writer has seen samples of Chinese and Japanese rices that were as badly infested with red rice as we ordinarily find in the Louisiana quality. There are cultivated varieties of rice that have a red grain, but the one that infests our fields is a variety that grows wild like other weeds outside cultivated areas in India. It has probably become distributed to all rice producing countries. Uufortunately it freely mixes with our white rice, and as the rice plant is wind pollenated, crossing may take place at considerable distance from the white. It must be remembered that imported seed may contain red rice. Planters have been prone to think imported seed must of necessity be clear of red rice or it would not be imported. It is not infrequent that imported seed contains as much red as does a good grade of the domestic rice.

Grains on the plant of white that are fertilized with the pollen of the red rice will have a red or pink cuticle, which will mill off in most instances. If, however, the seeds are planted, the red form of the parent stock is apt to show the stronger characters, and some red rice will be obtained. In short, the same rule holds good here that obtains in hybrids among plants and animals in general. Since the red rice is often allowed to grow in the main canals unmolested, there is no doubt in the mind of the writer that the pollen is often carried by the water and occasionally deposited where it fertilizes the white rice. Pollen-eating insects no doubt frequently carry the pollen on their bodies and often bring about cross fertilization. We have no positive observations on this matter, but since they will cross easily, it is highly probable that these agents, unobserved by the planter, are responsible for much of the red rice where the land was thought to be free from the pest. While the flowers are not frequented to any considerable extent by nectar-seeking insects, pollen-eating insects and beetles are very frequent visitors to the rice flowers. For these reasons the farmer should be as careful about destroying red rice in his canals and about the fields not harvested, as he is with the main crop. All these things must be appreciated by the farmer before the problem will be successfully dealt with. The work of extermination must be directed along two lines, first, to prevent the plant from coming to flower, and, second, to secure the destruction of the seeds already in the ground. The fact that no seeds are allowed to mature one year and there is still an abundance of red rice the next year need not cause discouragement.

Before the seed will germinate three favorable conditions must obtain at the same time: sufficient warmth, moisture and free oxygen. There seems to be good evidence that the seeds may remain buried in the soil for at least a few years without being destroyed, and then germinate when favorable conditions prevail. If we prevent seeds from maturing this year, next year we may plow so as to bring seeds to the surface where they will germinate, that would have otherwise remained encased in the compact clay.

In making an effort to prevent the red rice from maturing seeds, the plants should be destroyed as soon as possible after they can be easily detected, certainly before they have come into full blossom. If any are left till the general harvest, the maturing of the second crop of seeds must be prevented. Large planters who have their fields already badly infested, would probably be unable to pull out the red rice, and must leave it to be cut with the white. There are few, however, who cannot prevent the maturing of the seeds that so often develop on the suckers that shoot up soon after harvest.

For securing the destruction of the seeds already in the soil, no plan can be suggested that has no objectionable features. The plan followed by some of the best planters of plowing the land early in the spring and allowing it to lie fallow, and again plowing in the summer, is probably as good as any now practiced, as far as the destruction of the seeds is concerned. The seeds that find favorable conditions for germination in the spring are killed by the second plowing, which brings other seeds to the surface and secures germination of the second crop, which will be killed by the frost. However, two plowings with no crop returns is to be avoided if possible, with equally good results in destroying the red rice.

The plan suggested by some of planting to some heavy crop like the velvet beans, or cow peas, would accomplish the destruction of the first seeds that germinated, but after the soil becomes shaded it is doubtful if other seeds will germinate. Some system of cultivation that involves stirring the soil several times and giving a minimum of shade will probably be found to give the best results. Oats might serve this purpose, as they could be harvested early and be followed by cow peas.

Allowing the land to grow up in weeds and volunteer red rice, as some do, is more objectionable in Southwest Louisiana than on the river. In the alluvial lands the weeds are so abundant and rank that the red rice is overshadowed and killed out. In the prairie regions the weeds do not accomplish this. In a favorable season a partial crop of red rice is matured, and much of it is shattered, even when harvested as hay.

If the land lies idle and is not plowed, it should be pastured so close that no seeds can mature.

Selecting pure seed is of the utmost importance. Where seed is imported and planted in the midst of areas infested with red rice, it cannot be called pure seed for the second planting, as will be seen from the above discussion.

We take the liberty of quoting the following extract from an address delivered by Mr. T. H. Winn, of Jennings, La., one of our most intelligent and successful rice growers.

"Then how are we to produce better grades of rice? I would suggest that the first step to be taken is to secure the very choicest seed to be found in this or any other country. Then to be sure to sow this seed in clean land; and again, see to it that you keep both the seed and the land clean. If every farmer in Southwest Louisiana who owns a quarter section of land and cultivates as much as one hundred acres of the same in rice, would ditch and drain his rice field so as to plant and properly cultivate fifty acres of this land in cow peas or some other leguminous crop, and the remaining fifty acres in rice, putting the same amount of work on this fifty that he did formerly on the hundred acres, and alternate crops each successive year, I'll venture the assertion that he will then grow more rice and better rice on the fifty acres than he is producing today on the hundred acres. In other words, his net returns from the fifty acres of rice land under the improved method would be greater than the income from the whole hundred acres under the present system. In addition, he would have the hay and food from the fifty acres of cow peas, which if properly harvested, cured and stored away and fed to his mules, his cattle and his hogs, would be worth as much to him as his rice crop, not to mention the fertility imparted to the soil.

"In pursuing this system of farming the planter would not only produce the major portion of his feed at home, and at the same time add immensely to the fertility of his soil, but he would also be dealing a death blow to his arch enemy—red rice.

"Again, because your lands are already foul, that is no reason why you should make them more so by sowing bad seed, but to the contrary, one should sow the very best seed to be obtained, for it is only through the greatest care in the selection of your seed and a continuous rotation of crops that we may hope to eradicate red rice from the soil. Eternal vigilance is the price we must pay for the renovation and regeneration of our foul rice lands.

"If the planters of Louisiana ever expect to get rid of this pest (red rice) we must not only eradicate it from the soil, but we must quit planting it. One is often asked: 'What causes it? Where does it come from? What makes it?' In my opinion God makes it; just as He did the white rice. It is a separate and distinct variety, if not a different species, from the white rice. In physical appearance the plant upon which it grows is very different from that of the white species. In the first place, the red rice does not grow so tall as the white; then the stalks of the red rice grow at an angle of, say, 65 degrees. The stalks never stand perpendicular and erect as does the white rice. Again, the heads are more sprangling and the grain cells distributed more unevenly along the head than is the case with the white rice. The plant is much more vigorous and the grain is not only different in size, shape and color, but possesses greater vitality. If the conclusion is correct that they are different species, the seed of one will not produce the other, for this would be directly in conflict with the evolution of vegetable life.

"When we contemplate the immense territory to be cultivated in rice in this State and in Texas the next few years, if this mania for canal building is kept up, then nothing but the choicest goods will go, and if we continue our present system of planting, '*Mene, Mene, Tekel, Peres*' will be the handwriting on the wall. Othello's occupation will be gone. But by the proper care and selection of our seed rice, rotation of food and leguminous crops, we may convert 'the winter of our discontent' into glorious summer, and all the debts that lower o'er our farms, in the deep bosom of the ocean bury."

ANALYSIS OF RED RICE.

An anaylsis of red rice grains, with hulls removed, was made by Mr. R. Glenk, station chemist at Baton Rouge, and is here given. It will be seen that there is scarcely any difference in food value of the red and white rice. From a nutritive standpoint it is as valuable as the white rice.

If this was generally understood, many parties would probably choose to economize by buying it at a price even considerably above what it now commands on the market, in preference to the brewers or lower grades of white. As a stock food it is worth more than it often sells for.

	Moisture....	Ash......	Ether extract....	Carbo-hydrates....	Crude protein.....	True protein.....	Fibre......	Total nitrogen...	Alb. nitrogen....
Air dry...	13.13	.80	2.20	77.59	7.56	7.31	1.10	1.21	1.17
Water free.	.....	.92	2.53	89.32	8.70	8.42	1.27	1.39	1.34

AVERAGE ANALYSES OF RED RICE, WHITE RICE AND CORN IN 100 POUNDS.

	Protein. lbs.	Carbo-hydrates. lbs.	Ether extract. lbs.	Dry. matter. lbs.
Red Rice	7.56	77.59	2.20	86.87
White Rice	8.14	72.01	2.50	87.58
Corn	11.50	78.60	5.60	88.10

RED RICE IN JAPAN AND HONDURAS VARIETIES.

The red rice of the alluvial lands where the long grained Honduras seed is used almost exclusively, seems to be identical with that found in Southwest Louisiana, where the short, broad Japan seed is used. It is probable that this species has been imported with both kinds of seeds.

Among the varieties of rice secured from the Department of Agriculture at Washington, one from Siberia was a red grained variety, very closely resembling our own, but maturing later.

LARGE INDIGO, STRAIGHT INDIGO, COFFEE WEED, SENNA, LONG PODDED SESBAN. (*Sesban macrocarpa*, Muhl.)

As this plant is most frequently known as large indigo, we shall use that name in referring to it.

After red rice, the large indigo is the most extensively distributed of the rice weeds. It is found more or less abundant in all sections of the State. It is the largest and most conspicuous weed we have, often growing to a height of fifteen feet, and if not crowded, the stem attains a diameter of two or three inches. The flowers are yellowish, with purple spots, and about an inch long. There are from fifteen to thirty pairs of leaflets in each leaf. A good sized plant will have fifty or more branches, each bearing from twenty to forty pods, each of which will contain from twenty to forty seeds. A large plant will mature a hundred thousand seeds. Where the weeds are thick on the ground, a much smaller per cent. of this number will prevail. It will be seen that one plant if allowed to mature a crop of seeds will produce enough plants to keep a man busy for some time in destroying them.

Unfortunately for the farmer, the large indigo grows well in dry land and wet. It is as bad in the corn as it is in the rice. It is not killed by water unless completely submerged.

If the seeds are harvested, many of them remain with the threshed rice and are a source of annoyance to the miller, as it is impossible to get all of them out. The seeds are possessed of a high degree of vitality, and may remain in the soil two or three years, and possibly longer, without losing the power to germinate. Fortunately it is not as readily distributed as some of the less productive weeds, or it would be uncontrollable. The seeds do not float in the water, but a moderate current may carry them considerable distances, as quite a number of them are found in the trash and other seeds drifted by the heavy rains. When other food begins to get scarce cows eat seed pods and often void the seeds undigested. It is not infrequent to find these seedlings in the cow stools. The seed pods do not split open freely, and many of the seeds may remain in the pods nearly all winter. Generally most of the pods hang on to the stalks all winter, or till they become whipped into frills by the wind. The non-fibrous portion of the pod decays and is broken away, leaving the stringy or fibrous portion of the pod hanging. In this way seeds are gradually shattered from day to day. This method of dropping the seeds is much more favorable for the preservation of the plant than if they were all dropped at once. Each heavy rain may wash away some of the seeds and lodge them in different parts of the field. Cattle frequently trample the seeds deep into the soil, where they will not germinate till brought near the surface by plowing.

The weeds are conspicuous and cannot escape observation. There is, therefore, less excuse for letting any of them reach maturity. When the plants are pulled up it is necessary to place the roots so they will become dried, as they will continue to grow if dropped back in the water. When this weed is the principal one to be destroyed, it is probably better to cut them with a cane knife than to pull them up, as it can be done much more easily, and few stems will send out any new branches below where they are cut off. It has been the observation very frequently repeated, that the weeds are not cut early enough, many seeds being matured before the stems are cut down.

The illustration produced elsewhere is one of many photographs that might have been secured, showing the weeds cut after many seeds had matured. The stubble has not yet been burned, and many of these pods will be consumed by the fire, more than would be if the weeds were standing. It is therefore better to cut late than not at all.

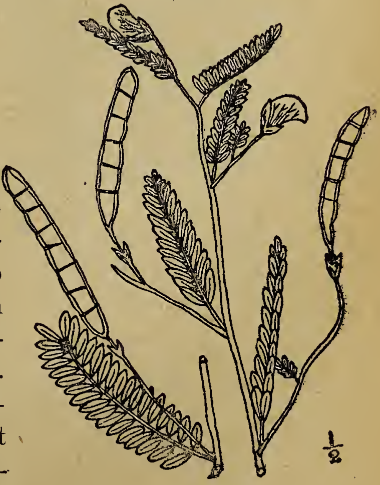
It is not possible to secure the germination of all the seeds in one year, but by devoting the land to a cultivated crop where the soil is stirred several times during the season, killing seeds that have germinated and bringing others to the surface to secure germination, will accomplish the destruction of the greatest number of seeds. But they must not be allowed to mature a crop of seeds after the cultivation is completed. These weeds sometimes develop very abundantly after corn is "laid by," and mature an abundant crop of seeds.

As an exterminating measure it would probably pay to go through the corn and cut with a scythe all the weeds that cannot be covered with cow peas. In good land a heavy crop of cow peas will keep most of them down. Cutting the weeds out of the corn might cost more than it would do the corn good, but it would be a good investment in future battles with the weeds.

This weed is rapidly increasing in abundance in Southwest Louisiana, and should receive the careful consideration of the planters throughout that section.

CURLY INDIGO, SENSITIVE JOINT VETCH. (*Aeschynomene Virginica.* (L.) B. S. P.)

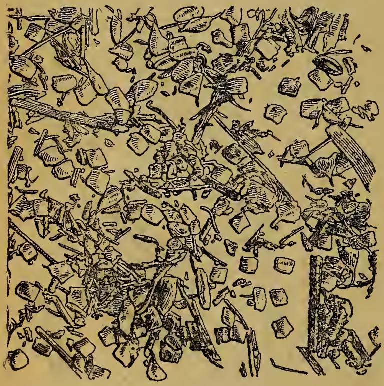
The "curly indigo" ranks among the very worst rice weeds. It is quite universally distributed over the alluvial districts, and is gaining rapidly in Southwest Louisiana. Although belonging to the same family as the large indigo, it is quite unlike it in many respects as to character and habit of growth. In stead of standing tall and conspicuous like the large indigo, it is generally not more than two or three feet high, and branches more freely. The leaflets are smaller and are somewhat sensitive, closing together when suddenly touched. The flowers are redish yellow, and about a half inch long. There are from six to ten seeds in each pod, and a thousand to three thousand seeds to the plant. It matures earlier than most weeds, and has almost perfect provision for dissemination. The pods are broad, flat and segmented. The pod does not split open, but breaks into as many segments as there are seeds, a portion remaining around each seed. These segments are about square



Curly Indigo. Aeschynomene Virginica, one-half size, showing segmentation of pods.

and will float on the surface of the water, and become very widely distributed. As the pods near maturity, a severe shock, such as would be given by the stroke necessary to cut the stem, is sufficient to break up some of the pods into their respective segments. The portion of the pod surrounding the seed is of a corky nature, and is comparable to a life preserver about the seed. The seeds are floated away on the flood water, or falling on dry land are subsequently trampled into the ground or carried away by the flood water during heavy rains, and may be lodged at a remote portion of the field. In early spring, wherever drifted trash is found, seeds of curly indigo are apt to be abundant.

The accompanying cut, reproduces a photograph that was taken from such a drift, and was not selected as being the most abundant in these seeds that could be found. It was an average sample from the field. In some cases the drift is composed almost entirely of these seeds. As a half cart load of such material may sometimes accumulates in one place, it would be advisable to burn all such trash heaps, instead of scattering them with the plow and turning the seeds under. Quite a number of parties told the writer that they had not observed that these trash piles contained seeds, as they thought they were only fragments of sticks. This weed grows abundantly in many places along the ditches parallel with the railroads. Vast numbers of seeds are matured along these banks, and subsequently washed into the fields further back. The planter should be careful to destroy all growing plants of the curly indigo where either currents or back water can bring the seeds onto the rice lands. When the seeds are harvested they may pass through into the rice and cause some annoyance at the mill.



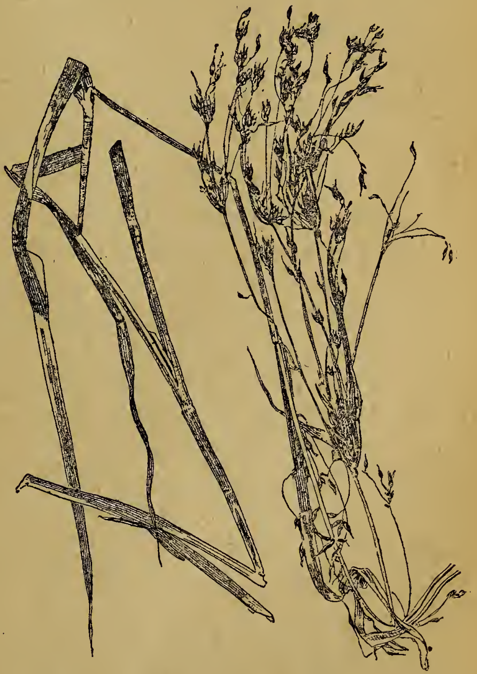
From pnotograph of drift trash on rice field. Small quantity spread out. Sharp angle bodies are segments of pods of "curley indigo," one-half natural size.

The planters in Southwest Louisiana should beware of this weed. If it gets started there, it will probably prove to be the worst weed they could introduce. Unlike the large indigo, when the stem is cut off, new branches will be sent out from below and soon mature seeds.

TADPOLE GRASS, WIGGLE-TAIL, SPEAR GRASS. (*Rhynchospora corniculata.* A. Gray.)

The common name is given because of the resemblance of the seed to tadpoles.

This plant is not a grass, but belongs to the sedge family. To one not accustomed to making botanical distinctions, it looks very much like a coarse grass. The stems are from two to four feet high, generally just a little higher than the rice. They frequently occur in rather large clusters, and head out and mature seeds a week or more in advance of the rice. The brownish red color of the heads renders them easily seen. The stem and leaves die at the approach of winter, but the roots live and the shallow plowing practiced in the rice fields does not always kill them unless the roots are left well exposed, or pulled out by the harrow. The plant produces a large number of seeds, some of which are shattered before or during the harvest. The seeds float on the water and may be widely spread in this way. The plants are found in all parts of the State, although in many places it is not abundant enough to make it a serious pest. It grows normally in wet places, and may therefore be reduced by dry crop rotation. It is not very common toward the front of the river plantations, but increases toward the swamp, and the lowest portions of the fields have the



"Tadpole grass." Rhynchospora corniculata' broken and folded, showing abundant flower clusters one-quarter natural size, greatest quantity of it. It is frequently quite abundant just outside the area cultivated, and from such places in many instances the seeds find their way into the fields.

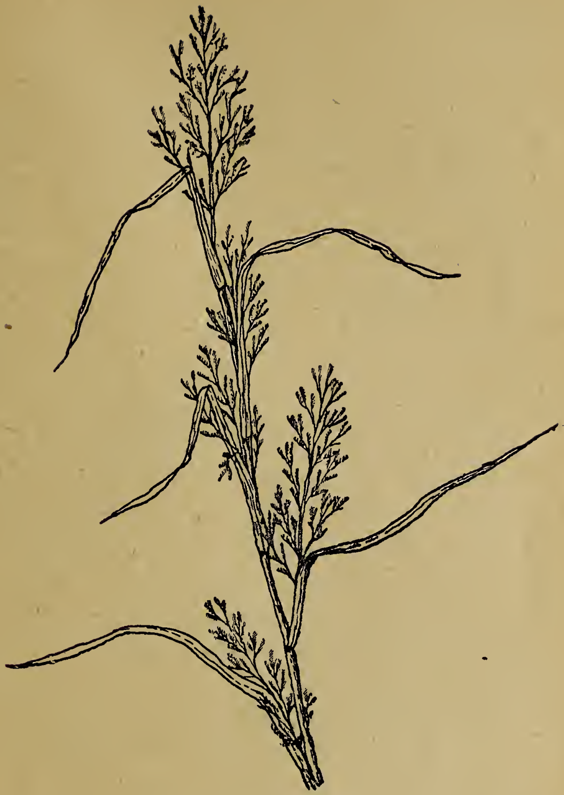
In the prairie regions it is found along nearly all the ponds and little streams, and from these places it is rapidly spreading as the adjoining areas are brought into cultivation in rice, giving favorable conditions for development of the sedge. The seeds frequently go through the mills and into the polished rice. It is therefore regarded by the miller as a bad seed.

Since the only sure way of getting rid of the stools that are already formed is to take them out of the ground, either by plowing and repeated harrowing with a toothed harrow, or pulling them out by hand, it might be well to clean the field of all the old plants during the late fall and winter when other work cannot be done. The stools of the plant are easily recognized in winter, and could be as easily pulled out then as in the spring after the crop is on hand.

BULL GRASS. (*Panicum agrostidiforme.* Lam.)

Of the grasses proper, bull grass is the worst in rice. Few if any fields of the alluvial lands are free from it, and it is common in the prairie regions. It produces thick, stout stems, 3 to 5 feet high, stools freely and branches profusely, making this one of the most prolific seed bearers of all the grasses. If the stem is cut or broken before the seeds are matured, every joint below the injured place may send out a branch and soon mature seeds. The stems become as large as a man's smallest finger, and a plant that has stooled freely, and come to maturity where not too closely crowded, becomes so firmly rooted in the soil that one man cannot pull up a bunch of it. It is normally a water grass, and it is a very difficult matter to get the start of it sufficiently to hold it in check by flooding.

The seeds are small and float on the surface of the water, thus materially aiding in the wide distribution of the plants that will be produced during the following year. However, as the seeds are light, the fans can easily separate them from the rice, and serious damage is done to the growing crop only. Another feature of the adaptation for distribution is that the panicles are somewhat after the order of the "tumble weeds," and after becoming detached from the stem are rolled considerable distances by the wind, scattering



Flowering portion of "Bull Grass," showing method of branching and seed production, one-fourth natural size.

the seeds as they go, affording a good illustration of how an outside area may be a constant source of annoyance.

This weed is found along the ditch banks possibly oftener than any other weed, and it would be economy to spend some time to secure its destruction wherever it may be found adjacent to the rice fields, or on the banks of ditches leading the irrigating water to the rice fields.

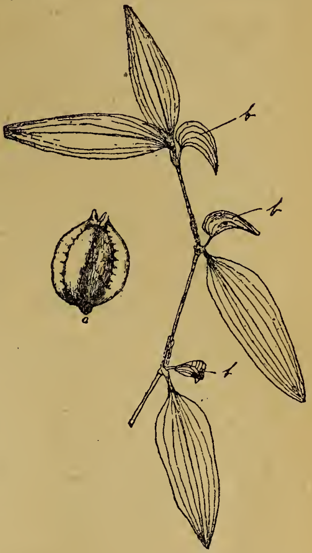
SMART WEEDS. (*Polygonum,* especially P. *acre.*)

Smart weeds take an intermediate position in the list of bad rice weeds. They normally live in the water, and in exceptional instances are the worst weeds on a plantation. They are moderately abundant in most places that are naturally poorly drained. They are apt to mature a crop of seeds after the rice crop is harvested, as they are not eaten by stock or insects, because of the bitter, pungent taste of the leaf and stem. Where the rice is harvested with a sickle, most of the weeds are avoided, and the seeds do not accompany the rice to the mill. Where machines are used for harvesting the rice, the smart weeds are harvested also, and many of the seeds will be sent to the rice mills. They do not bother the better grades of the finished product, but may pass into the brewers or will be in the screenings. As the screenings are used for feed stuff, there is a possible danger from feeding an excessive quantity of these seeds. The writer has not been able to find any experiments in feeding these seeds, but it is probable that the seeds possess to some extent the acrid principle that characterizes the stem and leaves. Screenings containing these seeds should therefore be fed with caution. See also note on dissemination of seeds from feeding.

Smart weed. Polygonum functatum, two-thirds natural size.

TURTLE BACK. (*Commelina. Virginica.*)

While these weeds are quite bad in the fields, compared with other weeds, they are possibly not as detrimental to the growing rice as the seeds are to the threshed grain. When the millers are askd what is the worst rice weed, from the millers' standpoint, most of them will answer that in the river rice the turtle back is the worst, because it is the hardest to separate. This plant is not abundant in Southwest Louisiana, and it would be well for the planters there to guard against its further spread. The plant resembles a grass, but the leaves are broader than in most grasses, and there is a blue flower in the angle betweeen the leaf and the stem at all of the top joints. Being a water weed, flooding does not kill it out. The stems are rather weak, and seldom stand erect. Some of them find support by resting between the blade and the stem of the rice, and manage to raise their summits into the head of the rice. They have no tendrils, neither do they twine around the stem, but often become well entangled with the head, so that the harvester, even with a sickle, gathers a considerable number of them. The structure of the seed pod is extremely interesting from an economic standpoint. It generally has three compartments, two of which may open after maturity, and drop the bare seeds, one or two from each compartment. The third cell does not split open at all, but with half the wall of each of the other cells, forms a little boat in which the contained seed may float away on the surface of the water. This portion of the seed pod, with the inclosed seed, somewhat resembles the turtle shell, hence the common name "turtle back."



"Turtle Back," Commelina communis, one-fourth natural size.

The leaves marked b each contain a seed capsule; a represents a seed with a portion of pod adhering, forming what is called the "Turtle Back" natural size.

The plant thus provides that if the fruition is not disturbed, two-thirds of the number of seeds matured will be dropped in the vicinity grown, while one-third the number may be carried to new homes whenever the ground is flooded. If the plants are harvested with the rice, the thresher splits the pods not already opened, emptying two of the chambers, while the third sticks close to the inclosed seed. If this seed is not well matured, or the wings are not broken away, the fans of the thresher will take many of them out, and the mills can take out the remainder. But if the wings are broken by the cylinder of the thresher, or the seeds are extra heavy, they pass into the hullers and it is impossible to get the seeds out of the rice, Of the seeds from the splitting cells of the pod, some are separated by the thresher. The smaller ones and the short ones (when two are in one cell, they are short with one square end) mostly go with the screenings, but the large seeds mostly go with the polished rice.

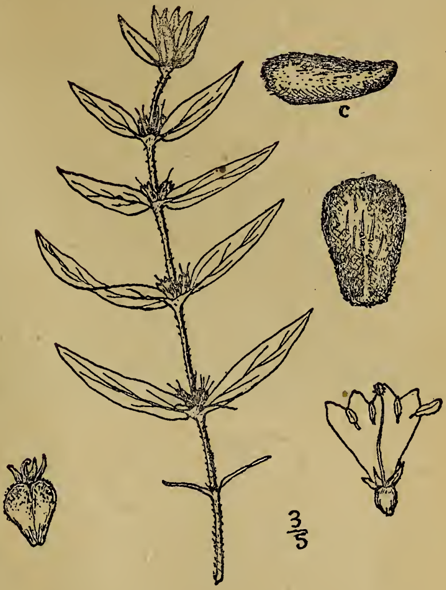
To one not acquainted with the seed, the sight of them at once suggests that mice have been stooling in the rice. As the plants continue to grow till nearly frost, a good crop of seeds may be matured after the rice is harvested. They are about the last thing in the field to quit growing in the late fall. If the plants are broken from the roots and the stem comes in contact with wet soil, it will take roots at the nodes and continue to grow.

It is apt to mature seeds along the ditches that are not kept well cleaned, or in low, wet places most everywhere. In the late fall the top leaf often breaks from the stem with the pod and folds over it, and the whole thing floats when an opportunity is offered. What seems to be a short folded leaf only, contains a pod with from one to five seeds. In examining the rice fields the last of January, where the stubble had been burned in the fall, the ditch banks held a great many leaves, thus enfolding the seed pods. They had probably been washed in from outside areas, and lodged there.

The stem begins flowering at the ends of the branches, the last leaf partly enveloping the pod, the bud in the axil of the leaf next below then develops, becomes the main stem, produces a flower, and the same process is repeated, until late in the fall. In this way a large quantity of seeds are produced during the season.

ALLIGATOR HEAD. (*Diodia teres.*)

This plant gets its common name from the striking resemblance of the fruit to the upper jaw of an alligator. The weed is quite generally distributed over the State, and the seeds are considered among the worst that come to the mills. The growing plant, however, can hardly be said to be one of the most detrimental to the growing rice, as the weed is not of very rank growth, and seldom attains half the height of the rice. It is most abundant where high places occur in the fields, and if the rice is standing erect at harvest, and the stubble is left high, little of the Alligator Head is harvested. If the rice is harvested by the binder, and the blade for any reason has to be lowered, these plants are cut and carried along in the butts of the bundles, and in this way reach the threshing machine, and the seeds are too heavy to be blown out by the fans. In the mills, the fans and sieves are not able to separate all of these seeds without considerable loss of rice. The seeds are about as thick as a rice grain, and therefore pass into the better grades or head rice.



"Alligator Head." Diodiateres. Drawing below at the left shows the seeds at maturity, slightly larger than natural size. Two upper drawings at the right show enlarged side and back view of the "seed."

It produces two seeds to every leaf, between the leaf and the stem. This is not a large number compared to what some of the other weeds produce, but they are better protected and are provided for keeping up their number by the increased vitality of the seeds. At maturity the seed pod splits into two equal parts, each part enwrapping a seed, which it continues to enclose till germination. The surface of the seed pod is covered with fine hairs that are somewhat repellant to water, and the seeds are not readily wet. The seeds float on the surface of the water, but may finally become wet and sink to the bottom. As the seeds are about the color of the soil they are not easily seen and are not apt to be picked up by birds.

These weeds are easily held in check if proper flooding can be secured at the desired time.

As it is a very hardy weed, fallowing will kill it out only when other taller and thriftier weeds are present in abundance to completely overshadow it. Stock grazing these weeds sometimes develop sore lips and gums, from the irritation of the hair-like spines that develop at the nodes of the stem. The weed is of the same character as the "poor Joe," or "poverty weed" of the hill lands.

Another species of the genus is

Diodia Virginiana.

which spreads almost flat on the ground or sends up stems obliquely to a height of a foot or more. This weed is exceedingly abundant in most fields in all sections of the State. It is not generally regarded as a very bad weed, but the writer thinks its importance is underestimated. The seeds are surrounded by a thick, soft, corky covering, which renders it light, and the fans are able to take nearly all lof them out of the threshed rice.

As soon as the land is drained, it seems to start out from almost everywhere and rapidly matures seeds. Plants that have survived the flooding grow to considerable length, rooting at the nodes.

BIRD'S EYE. (*Scleria*—Several species.)

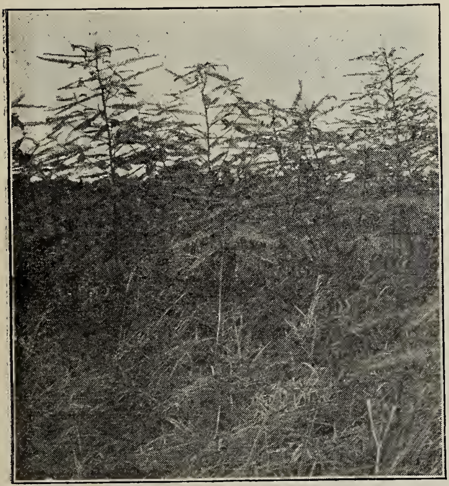
These plants belong to the sedge family, and look very much like grasses. Most of the planters call them grasses. This is another instance where the seeds are more conspicuous in the threshed rice than the weeds in the field. The seeds are quite spherical, with rough surface generally white, and about the size of a number six shot. Some of the seeds are darker and larger. It seems almost impossible to separate all of them from the head rice. Thorough drainage after harvest will materially aid in destroying these weeds as they are pre-eminently aquatic.

MORNING GLORY. (*Ipomoea tamnifolia.*)

As the morning glory is naturally a dry land plant, it is a matter of some surprise to find it so frequently in the threshed rice. The number of seeds would lead one to think the plant much more abundant in the field than it really is. It climbs and becomes so entangled with the rice that nearly all the fruiting

WINTER CONDITION OF A RICE FIELD.

Large indigo stands out prominently.



LARGE INDIGO WEEDS ON THE LEVEE IN A FIELD.

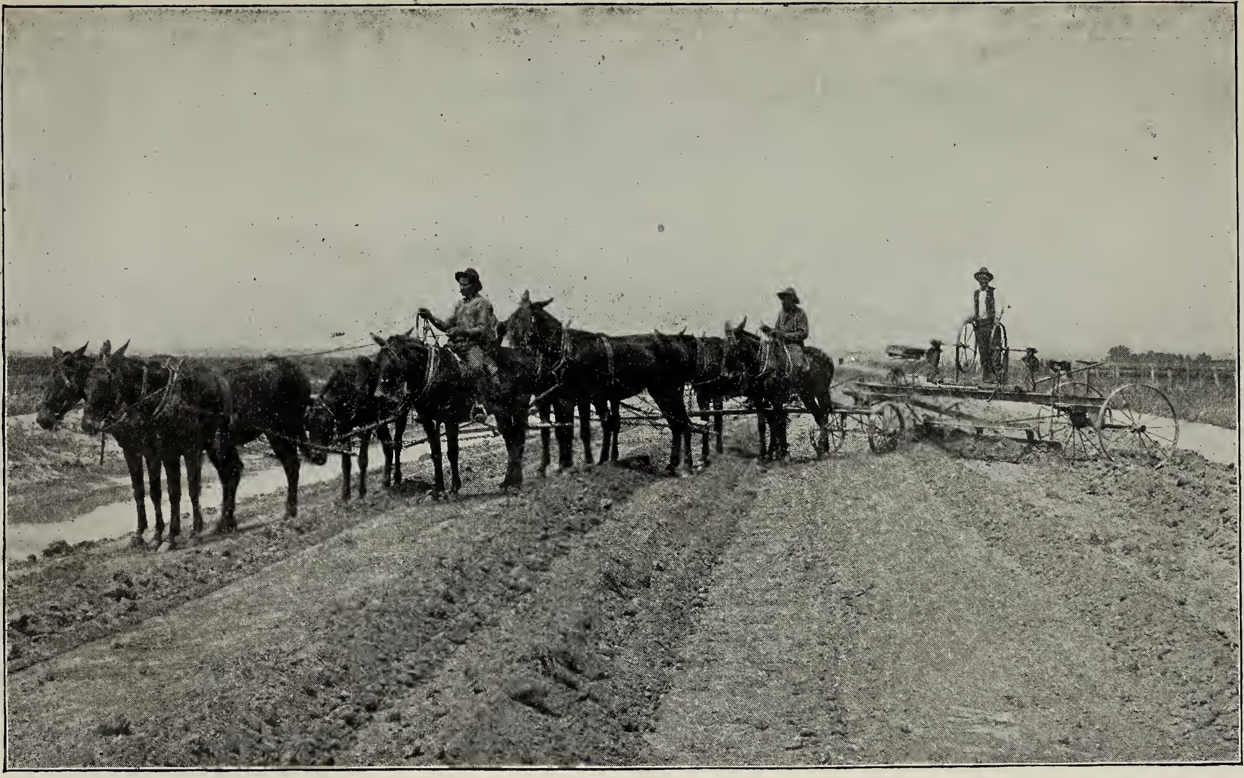
Taken after a storm, just before harvest. Row of weeds marks cross levee.

LARGE INDIGO (SESBAN)

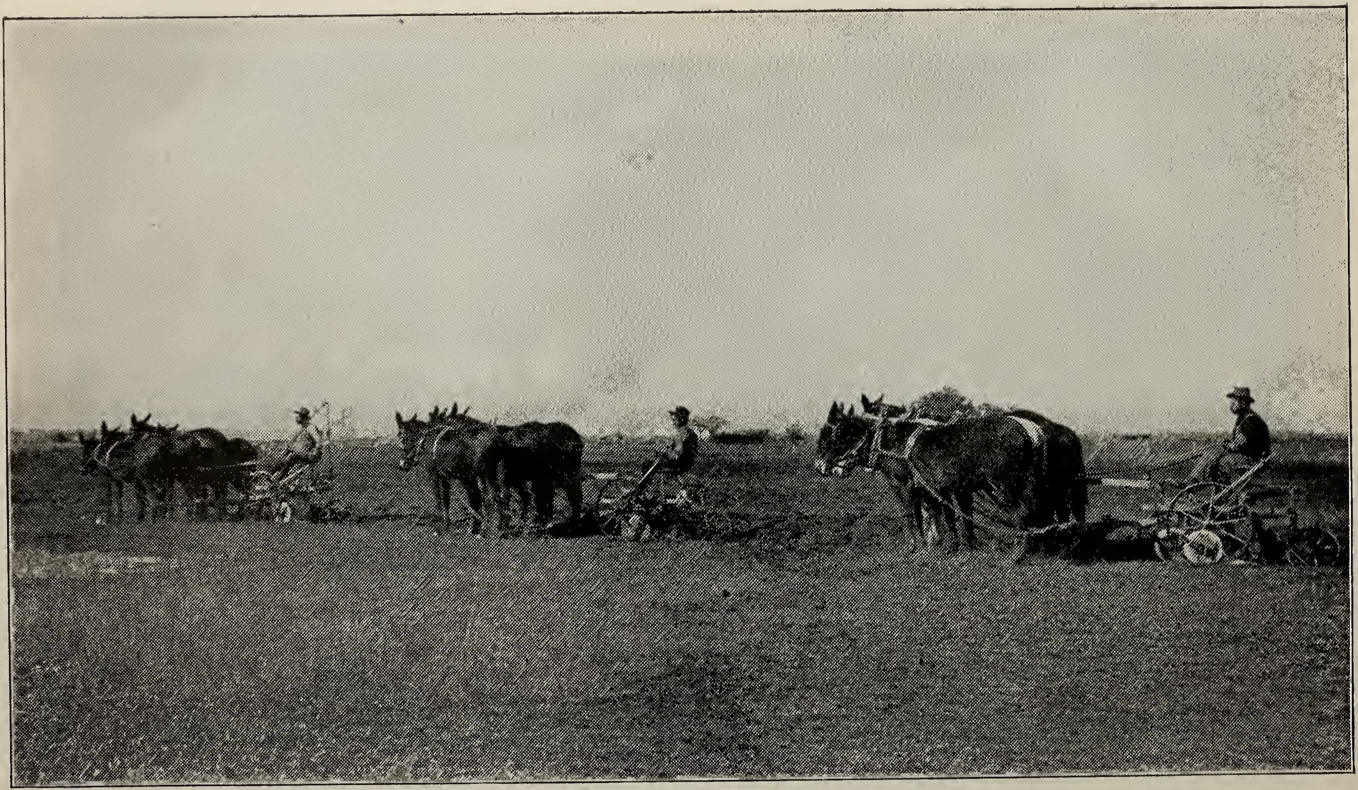
Cut with cane knife before burning the stubble.

A SERIES OF HIGH PLACES IN THE FIELD, NOT FLOODED.
Grown up in "large indigo" (Sesban) weeds.

RICE READY FOR THE HARVEST.
Large indigo stands high above the rice.

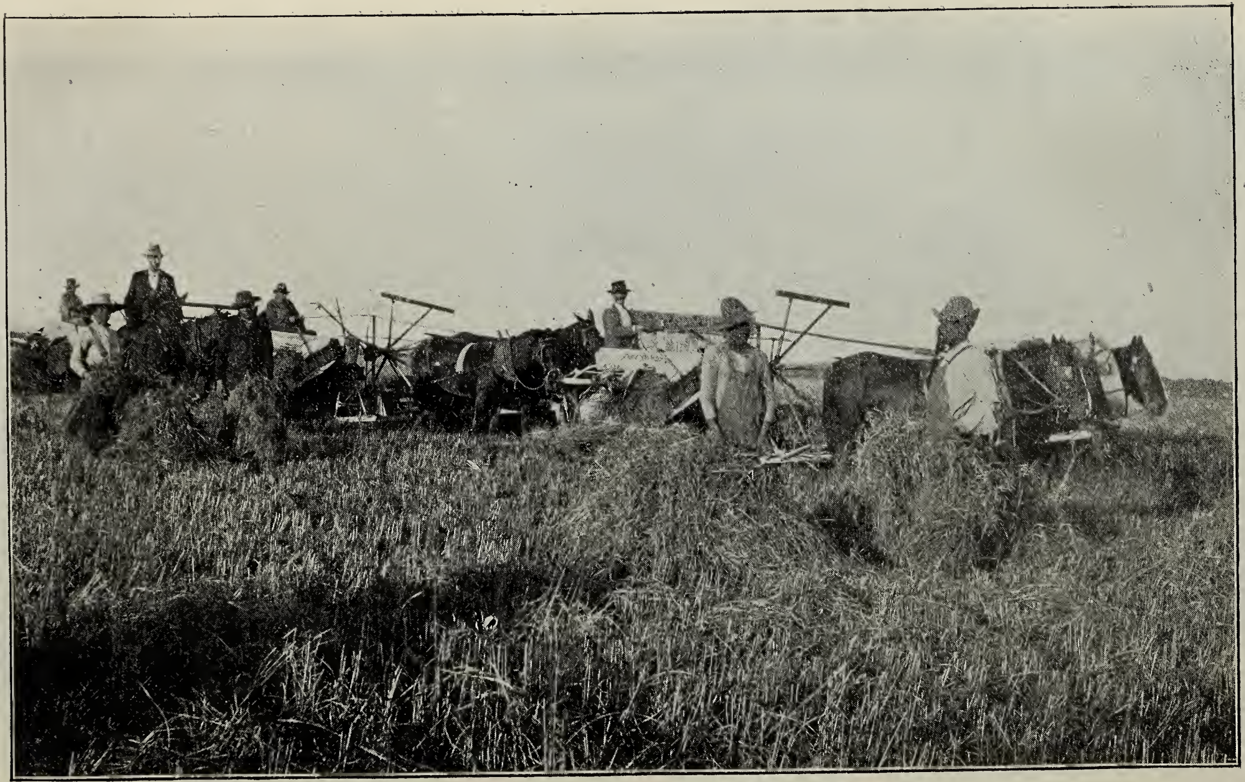


BUILDING LEVEE OF CANAL FOR IRRIGATING RICE IN SOUTHWESTERN LOUISIANA.

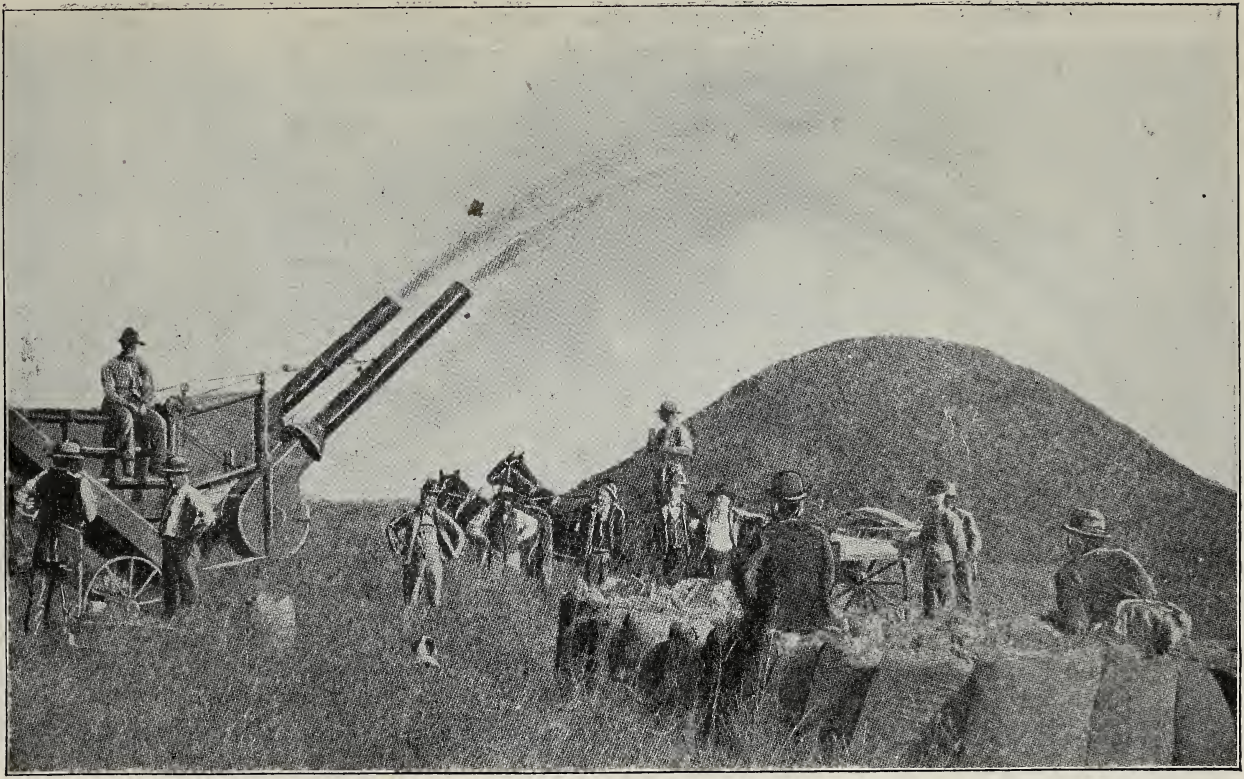


BREAKING PRAIRIE SOD FOR RICE, SOUTHWEST LOUISIANA.

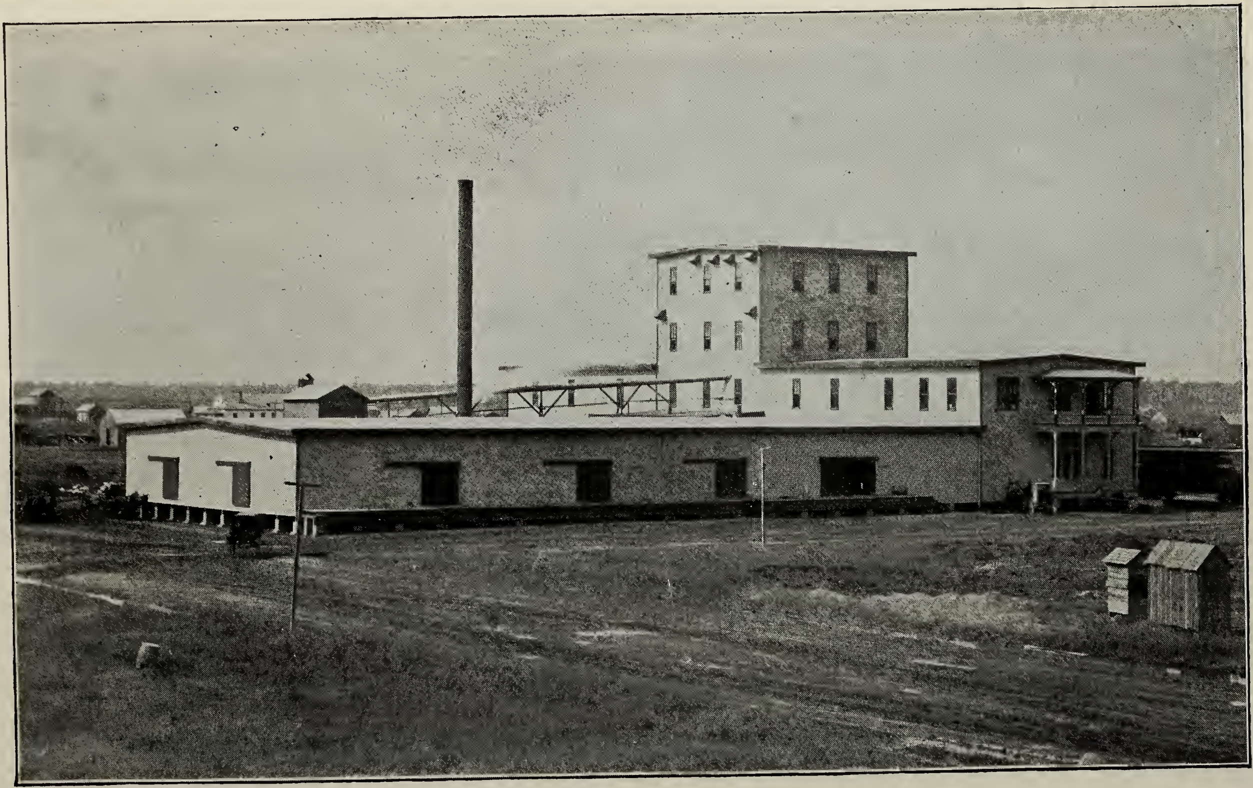
TYPICAL RICE FIELD UNDER IRRIGATION, JUST BEFORE RICE BEGINS TO HEAD.



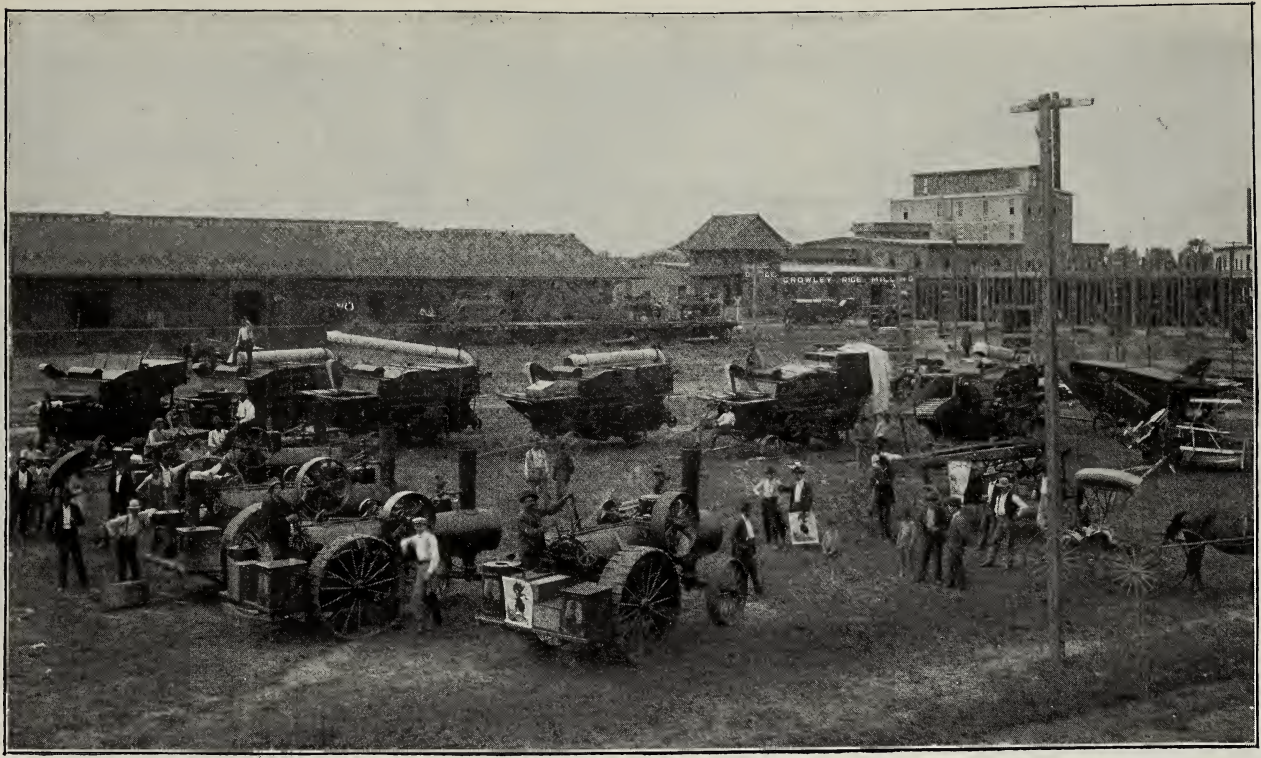
HARVESTING RICE IN SOUTHWESTERN LOUISIANA.



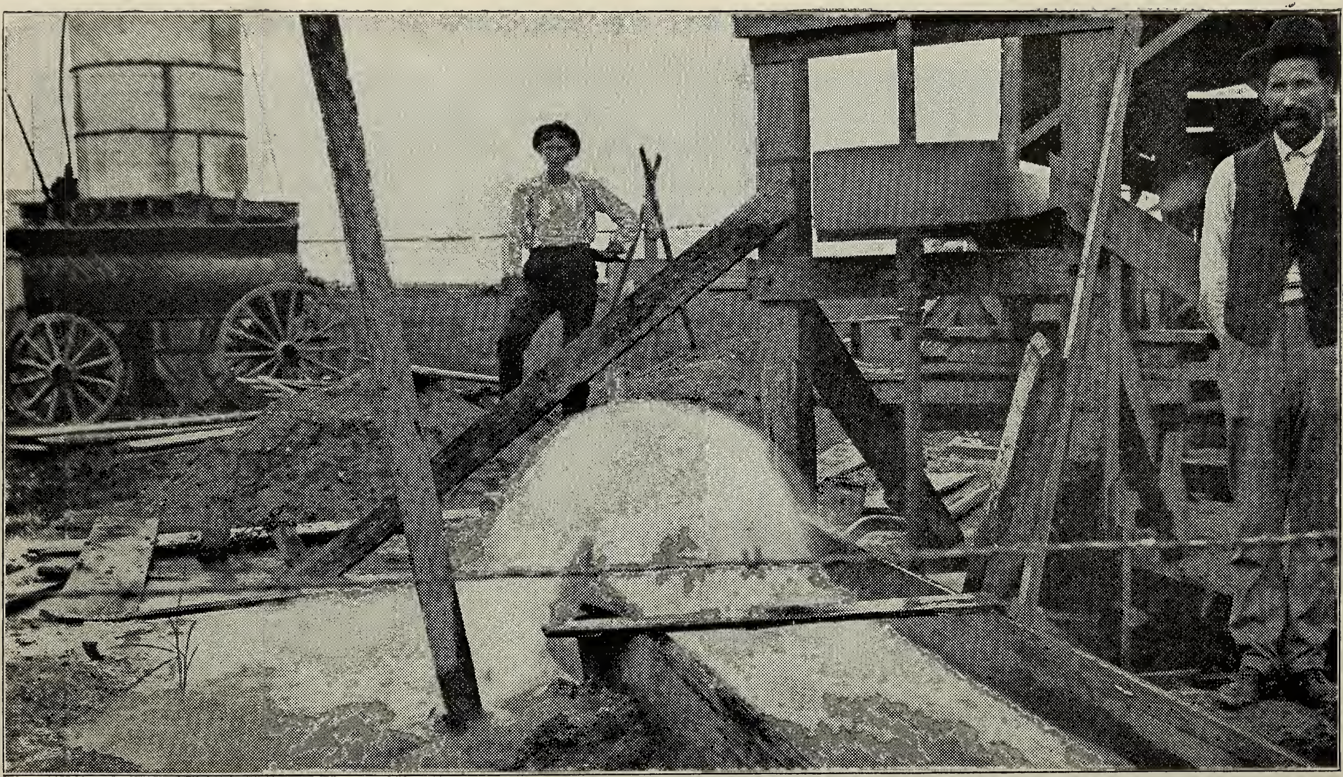
THRESHING RICE IN SOUTHWESTERN LOUISIANA.



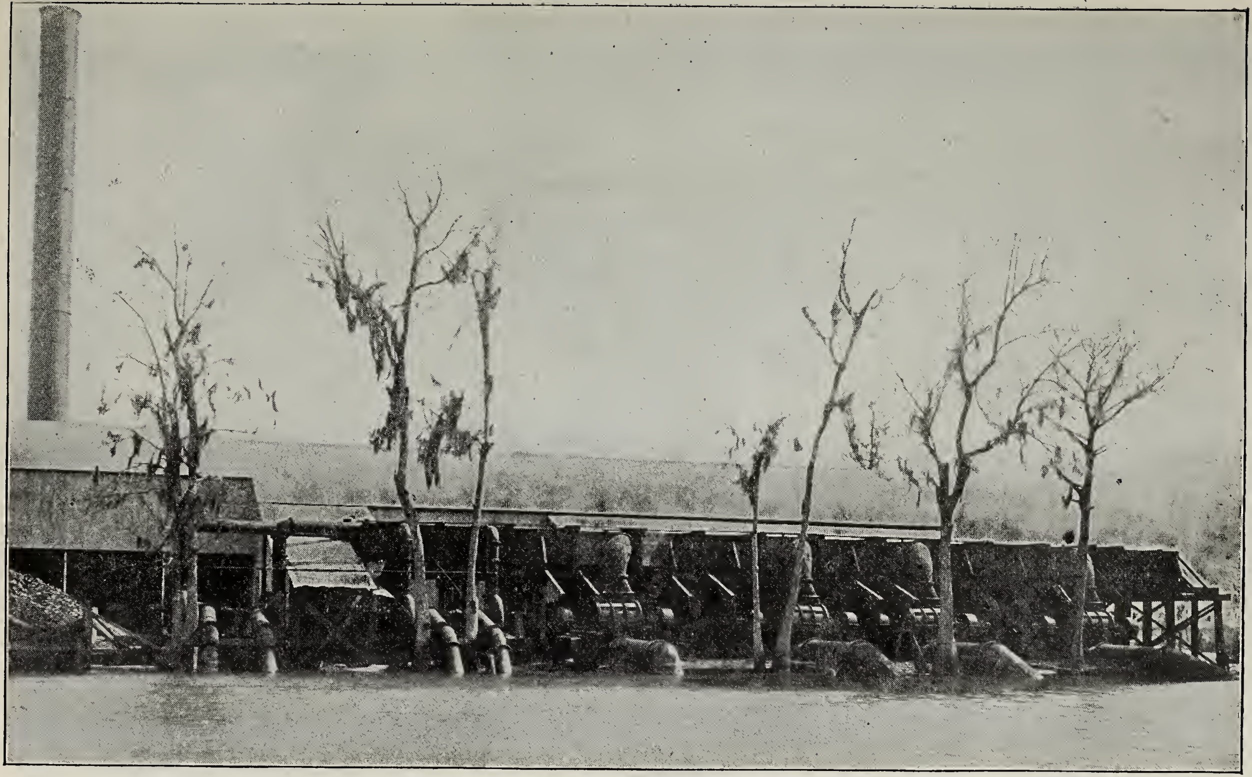
SIDE VIEW OF TYPICAL RICE MILL OF SOUTHWESTERN LOUISIANA.



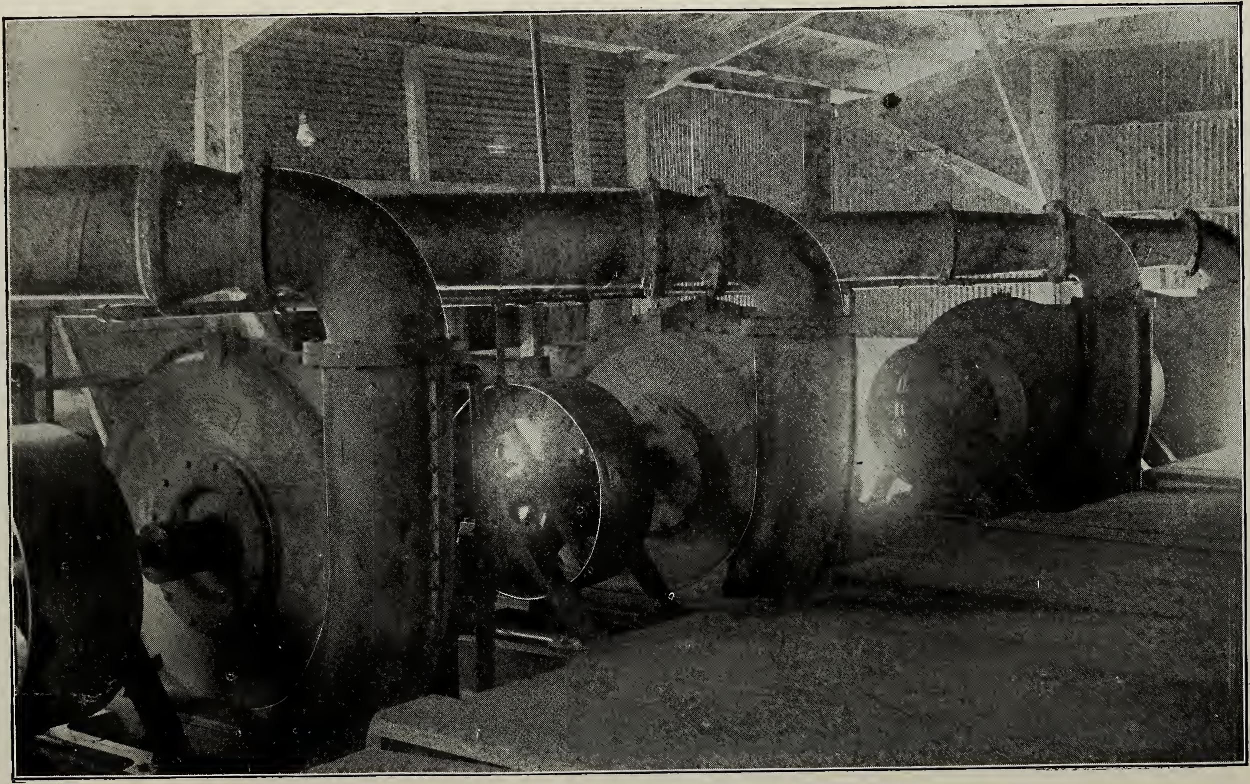
UNLOADING THRESHING MACHINERY FOR RICE CROP IN SOUTHWESTERN LOUISIANA.



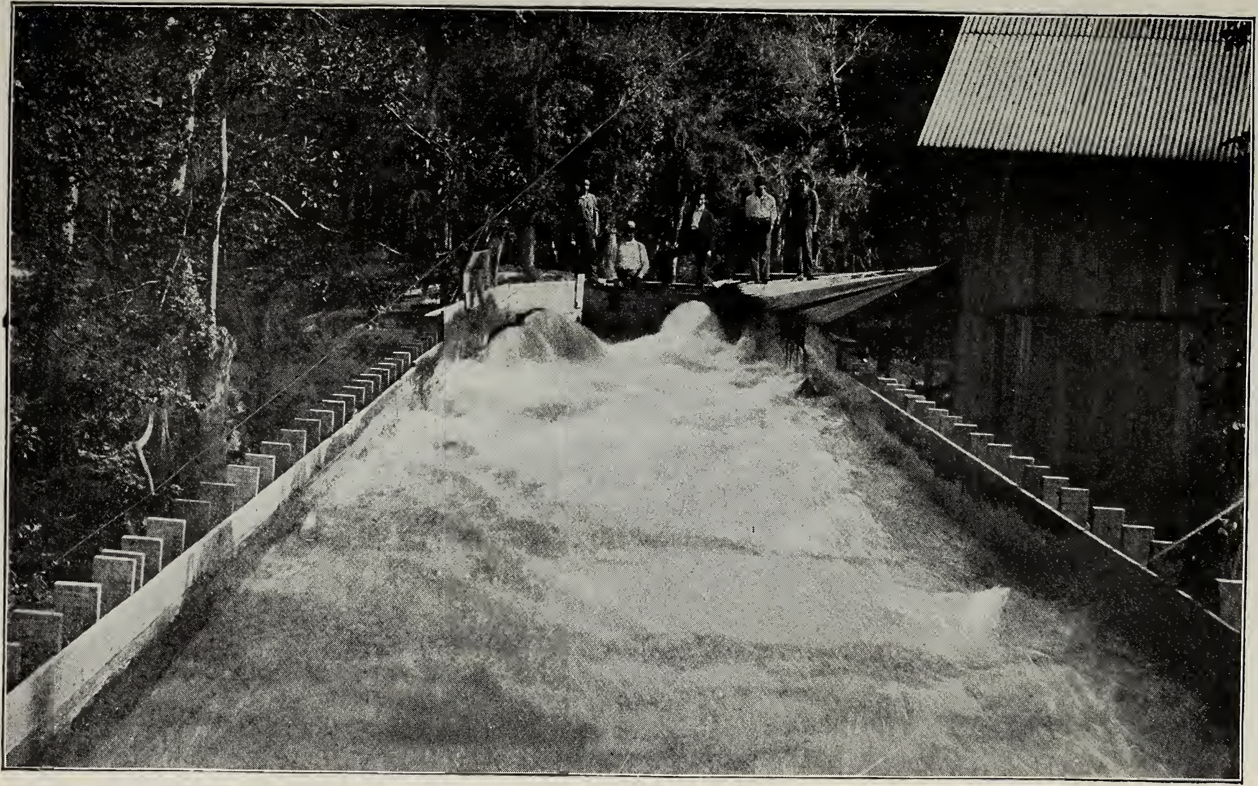
PUMPING FROM DEEP WELL FOR IRRIGATING RICE, ACADIA PARISH, LA.



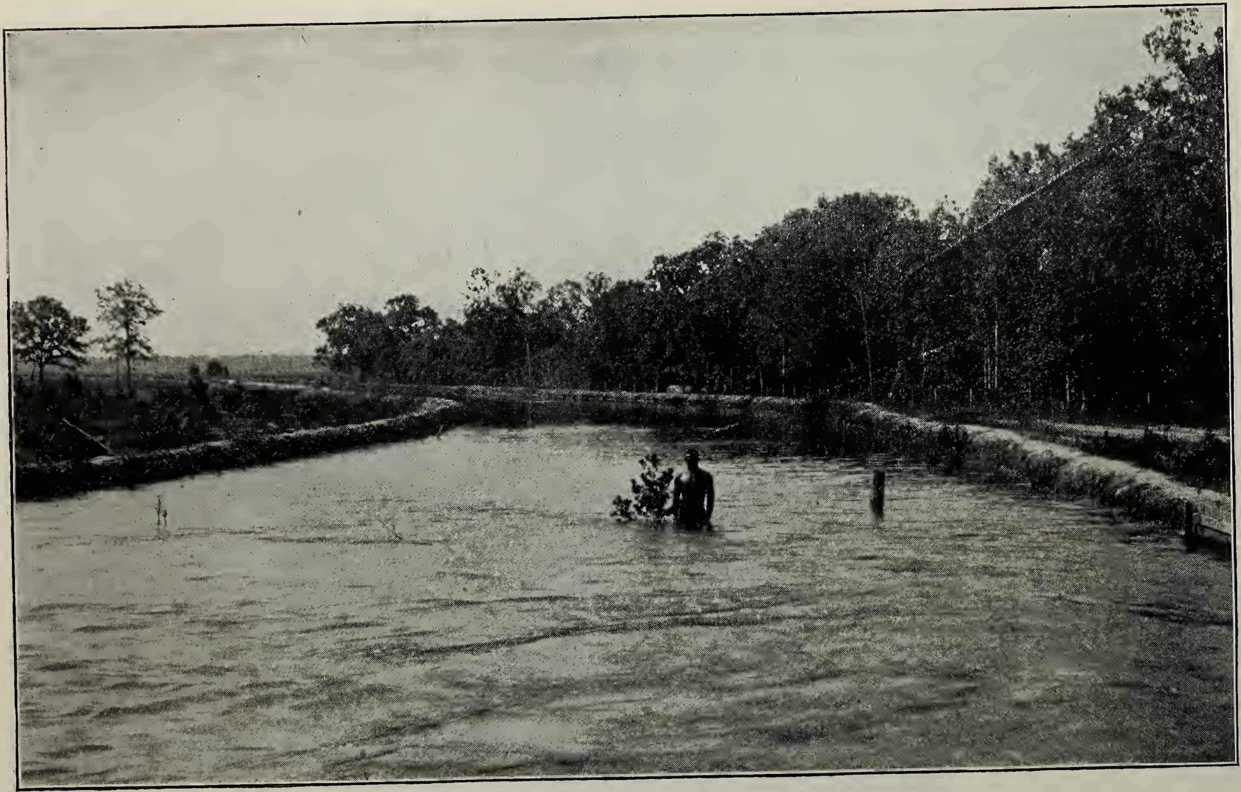
EXTERIOR VIEW OF PUMPS (four 24-in. pipes, four 12-in. pipes, irrigating 18,000 acres of Rice), ACADIA PARISH, LA.



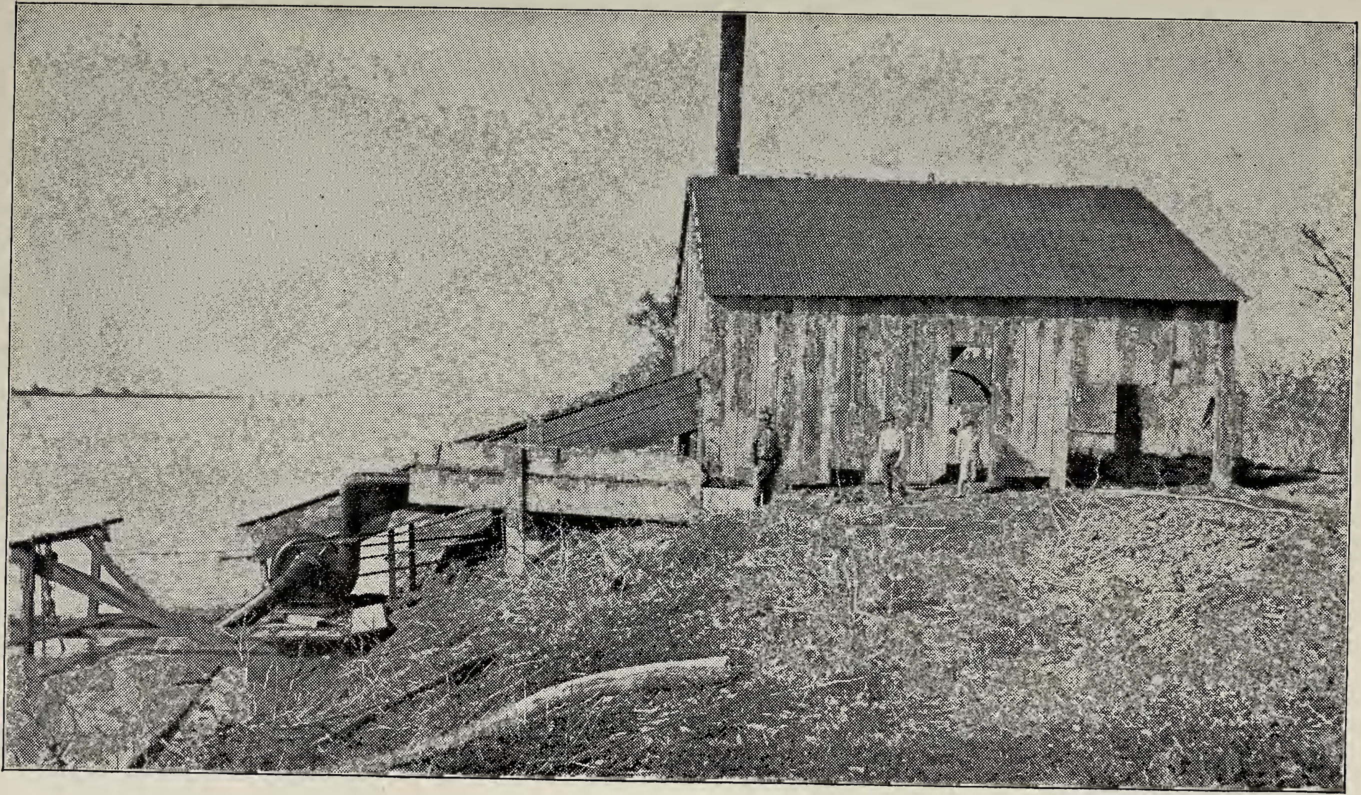
ROTARY PUMPS—INTERIOR VIEW OF A PUMPING STATION.



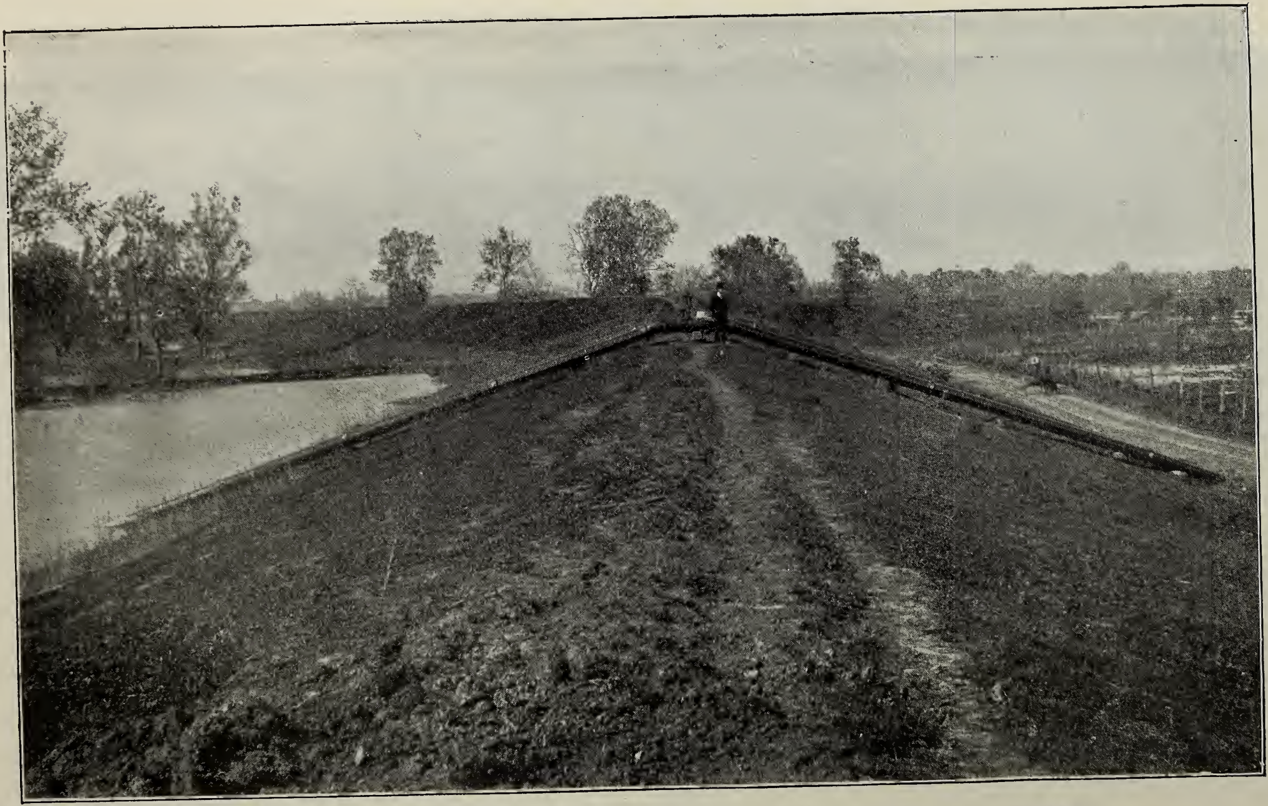
PUMPS DISCHARGING WATER INTO FLUME LEADING TO CANAL, FOR RICE IRRIGATION.



IRRIGATION CANAL VIEWED FROM PUMPS. RICE FIELDS TO THE LEFT.

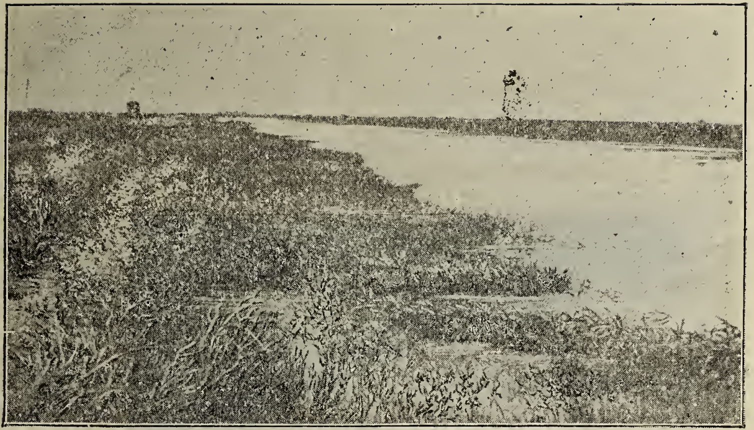


PUMPING WATER FROM MISSISSIPPI RIVER, IRRIGATING 400 ACRES OF RICE.



CARRYING WATER OVER THE LEVEE OF THE MISSISSIPPI BY SIPHON,

After it has been raised from the river to a pond at the foot of the levee.



Canal partly filled with Paspalum Fluitans.

Paspalum Fluitans.

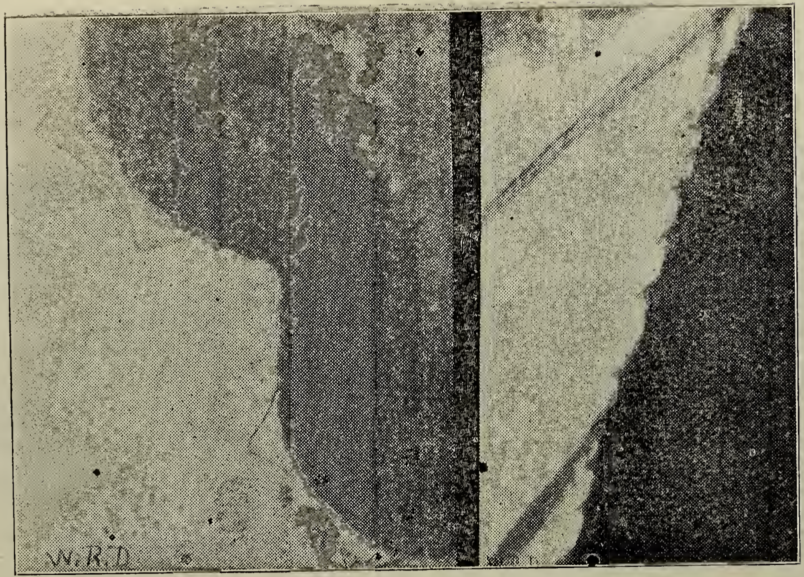


Photo-micrograph of section of rice hull. On right is magnification of about 50 times, showing fine saw teeth or spines on margin of hull. On left immature spines highly magnified.

portion is harvested. The seed pods form in large clusters, and, considering the size of the seed, each plant produces quite a large number. They are too heavy to be blown out by the fan in the thresher, but small enough to go through the sieves. From these reasons probably a greater per cent of the seeds pass into the threshed rice than any other weed seed. It may be seen how comparatively few plants in the field may show up a good number of seeds at the mill. The mills can separate most of them, but some of them are apt to pass into the higher grades of rice and cause diminution in the price it would otherwise command. The seeds have no special adaptation for distribution, and the plant should not be very difficult to control. Timely flooding, and a little hand-weeding in the high places, should hold the morning glory in check.

WATER GRASS. (*Paspalum fluitans.*)

This grass grows only in the water or on very wet soil. At present it is abundant only in a few places, and is now giving more trouble in the canals than in the fields. It is of very rank growth, the stems floating in the water and attaining a length of many feet. The stems and bases of the leaves are very spongy in texture, the spaces being filled with air, which renders the stem quite buoyant. The plants are generally attached to the soil at the base, but continue to live if broken away from the first roots. In fact, roots are sent out from every node that may take hold in the soil if they come in contact with it. It starts from the banks and rapidly spreads toward the center of the canals, until the entire mat will reach thirty or forty feet from the bank. In some instances it becomes so abundant as to impede the flow of water to such an extent that it becomes necessary to remove the grass from the main channels by raking it to shore. This has been done by hand. A little ingenuity on the part of some one may result in a rake operated by mules on the levees.

Since the grass does not ripen seed until late summer, it may be much easier to control it than if it seeded early. If the canals are drained as soon as possible after the last water has been drawn on the fields, most of it can be destroyed before seeds have matured. It may be necessary to mow the grass and burn it.

The plant is an annual, and if it is prevented form seeding, it will soon be exterminated. If the seeds are allowed to mature, they may be washed to the adjoining fields supplied with water from this canal and become a source of trouble there. While this grass has not yet proven to be a bad field weed, there is reason to look with suspicion on it. As pieces broken from the stems will continue to grow, it would be advisable to maintain a boom floating on the surface of the water to catch what pieces are floating before they reach the water gate.

Where it is just getting started, effort should be made to exterminate it at once.

The accompanying picture was taken in July, and the canal is about seventy feet wide, the grass having extended in about fifteen to twenty feet from each bank.

WATER GRASS. (*Paspalum virgatum.*)

This grass grows tall and erect in bunches, and is found to some extent in nearly all the rice fields, especially in Southwest Louisiana, where it is native to the prairies. It can be killed by flooding, if covered, and the seeds are nearly all removed, without difficulty, by the mills. It is one of the most common seeds in the screenings. Stock are not very fond of it, and it will mature seeds in pastured fields if there are any other grasses in sufficient quantity to maintain the animals.

MOSS WEEDS.

There are several species of small sedges that grow to a height of one to four inches that make quite a dense turf on the fields. These are of little injury to the rice directly, but they make a sod that is difficult to break up so as to get the soil in the best condition for sowing. They make their growth during the fall and winter and early spring. Probably the best way to deal with these weeds is to plow them under as early as possible, giving the sod time to rot before preparing the land to receive the rice. Thorough drainage will help to destroy them, as they are all plants that require a wet soil.

SEA WEED. (*Pongatium zeylanicum.*)

During the summer of 1903 quite a good deal of newspaper discussion regarding a so-called new weed, designated as "sea weed," caused considerable uneasiness in some localities. Upon an investigation it was found that the weed was an imported species, probably brought in with imported seed. The weed has been in the State for a numbr of years, and is now distributed all over the prairie section. It has attracted much more attention this year than ever before, but there seems to be no more occasion to be alarmed over it than there is regarding some of the weeds that have been in the State all the time. While a few cases are to be found where the crop has been abandoned to this weed, the newspaper reports were very much exaggerated and were not justified by the facts.

The weed is a vigorous grower, has a hollow stem, smooth slick leaves and stem. The flowers are not conspicuous, owing to the fact that the corolla drops off without becoming fully expanded, and only a few of them are to be found on the spike at one time. The seed capsules are borne in dense spikes, terminating the branches. The capsules break around the side and discharge vast numbers of very fine seeds that float on the water till they are thoroughly wet. This is probably their chief dependence for distribution.

The seeds have in all probability been imported with Honduras rice, but the writer has not been able to learn whether the weed is a serious pest in its native home.

MISCELLANEOUS WEEDS.

Besides the weeds mentioned in the foregoing, there are a great many others that are found to some extent, and even abundant in some places. In fact, some individuals have told me, and doubtless others will say that the weed that gives them the most trouble is not included in the above list. If such is the case, it is because the weeds are not generally distributed, or universally bad. It is believed that from the large number of rice fields visited, and from the samples of rice and screenings taken from almost all of the mills of the State, we have secured a fairly accurate opinion of the distribution of the worst weeds. To enumerate and describe all those that are bad would hardly be justifiable. If efforts are directed against the ones described according to the most rational methods, the same methods will serve for whatever others there may be.

AKNOWLEDGMENT.

We are indebted to the many rice planters who have freely contributed to the information herein contained, to the owners and managers of the rice mills of New Orleans, Rayne, Crowley, Jennings, Midland, Gueydan and others for uniform courtesies, and especially for the many samples of rice containing weed seeds and data regarding the same.

We are especially indebted to the Southern Pacific Railroad for its generous interest in these investigations, as manifested in furnishing transportation to the writer over its road throughout the rice belt.

PART III.

THE CHEMICAL COMPOSITION AND FEEDING VALUE OF RICE PRODUCTS.

By C. A. Browne, Jr.

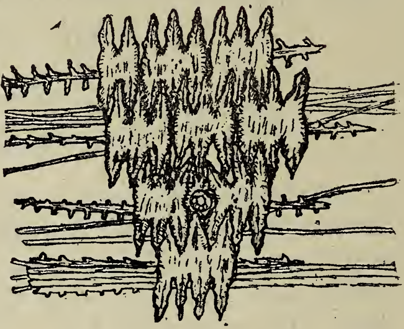
The study of rice products in Louisiana was begun at the Experiment Station in 1887. In Bulletin No. 9 of that year a number of analyses of rice bran and rice polish are reported, and attention is called for the first time to the feeding value of these products. Two years later Prof. B. B. Ross made a very complete study of the chemical composition of all the various products of the rice industry; the results of this work are found in Bulletin No. 24 of the station publications.

Owing to the remarkable increase in the rice industry in Louisiana during the last few years and the corresponding increase in the use of the various rice by-products as feeds for farm animals, a further study of these materials was deemed necessary.

Before taking up the chemical composition and feeding value of the various rice products, a brief description of the structure of the rice kernel and of the commercial process of milling will not be out of place.

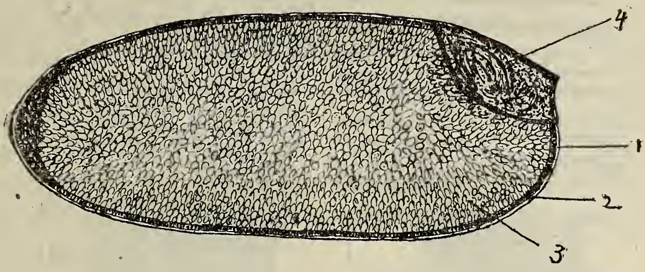
STRUCTURE OF THE RICE HULL AND KERNEL.

The rice grain, as it comes from the thresher and as it is sent to the mill, consists of the kernel with its outer hull or husk, the two being easily separated from one another. The hull is tough and fibrous, and impregnated with silica. Examined under the microscope, the hull is seen to consist on the outer surface of groups of parallel rows of jagged, comb-shaped cells, closely joining one another, with their joints interlapping. Beneath these surface cells is a compact tissue of fibers running lengthwise the hull. A magnificent section from a fragment of rice hull is shown in the accompanying figure (*Fig 1*) ; the appearance is so characteristic that the presence of ground rice hulls in adulterated feeds may be easily detected. When the hull is cut in cross section, the surface is seen under the microscope to present a scolloped appearance, as shown in the photomicrograph. These elevated portions overlie the fibro-vascular bundles of the hull, and at intervals are capped with minute spines. These spines are quite transparent, like glass, and are largely composed of silica. The photomicrograph shows these spines, as seen in a longitudinal section of the rice hull. They can be seen on the margin of the divisions of the hull without cutting sections. These jagged edges make the hulls feel rough when rubbed over one's finger. It can readily be seen how an excess of rice hulls in the stomach of an animal would cause extreme irritation to the delicate lining of the wall.



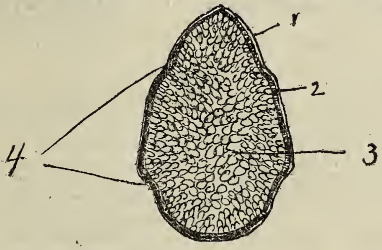
Highly magnified comb shaped cells, surface view of rice hull.

The rice kernel or grain has the general structure of other cereal grains, though differing somewhat in outward appearance. The surface of the rice grain is slightly marked with longitudinal depressions, which give it a fluted appearance; at one end is found the germ containing the plant embryo, not embedded in the grain, but freely exposed. The germ is therefore very easily rubbed off in the process of milling, the little nick at one end of the polished grain marking the place where it was located.



LONGITUDINAL SECTION OF RICE GRAIN.

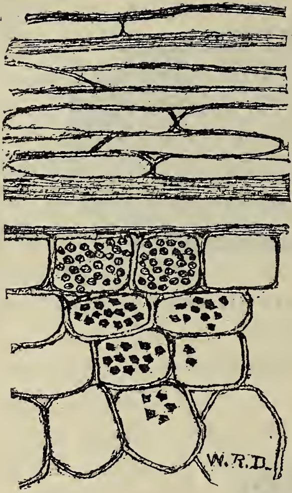
1—Cuticle of Grain.
2—Aleurone or Protein Layer.
3—Starch Cells.
Germ.



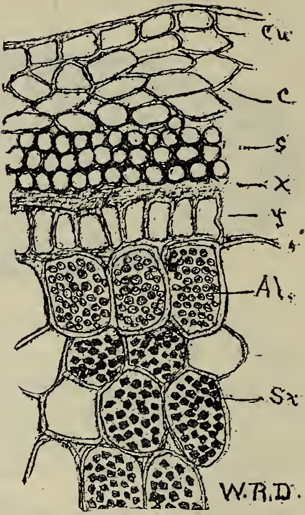
TRANSVERSE SECTION OF RICE GRAIN

1—Cuticle of Grain.
2—Aleurane Layer.
3—Starch Sells.
4—Longitudinal Depression in Grain.

On examining under the microscope a thin section cut through the surface of the rice grain, a number of tissues are discovered. There is, first, the outer skin, composed of different layers, as indicated in the drawing. (See illustration, *Fig 5 and 6*). Beneath this cuticle is found a second tissue, the so-called protein layer, the cells of which are stored with protein and oil. Under the protein layer is the central portion of the grain, quite uniform in structure, the cells being all filled with starch. The starch grains of rice are spheroidal in shape and are composed of many polyhedral granules. The grains present a very characteristic appearance, when seen under the microscope, shown in Figure 4.

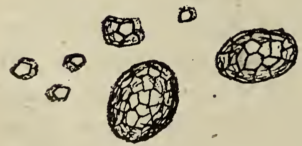


Highly magnified view of section cut across the long axis of rice grain. Cell layers correspond to lettering of cut on right.



Longitudinal section of rice grain, magnified about 900 times.

cu—Cutiele layer.
c—Layer showing green coloring matter in young grain, starch, etc., later becomes partially absorbed.
s—Several layers of cylinderical cells, containing some starch.
x—Layers not well defined.
o—Layers of cells along which the hull seperates from the grain in milling.
Al—Aleurone layer, rich in proteins, much of which is ground off in the bran and polish.
sx—Starch sells which continue to center of grain.



Starch grains of rice highly magnified.

MILLING PROCESSES.

To understand the manner in which the various rice products are obtained, the following description of the milling process is given, this being taken in part from Bulletin No. 24.

The rice is threshed in the straw by a thresher similar to the one used to thresh other small grains. It is now rough rice and is sold in this condition to the millers. The rough rice is first screened to remove all foreign particles and then passed to the milling stones where the outer husk is removed. Leaving the stones the material passes into horizontal screens, and through shakers and fans, where the hulls, chaff, broken and whole kernels are mechanically separated.

The next process in the treatment of the whole kernels is the decorticating process. This was formerly done by pounding the grain with large wooden pestles, weighing about 400 pounds, in large mortars also made of wood and holding from four to six bushels. Of late years the mortar and pounder have gone out of use, a small machine called the "huller" having been substituted. The huller, which resembles a large sausage machine in outward appearance, consists of a short horizontal cast iron cylinder fitted with ribs on the interior surface. A shaft, also provided with ribs, revolves inside this cylinder. The rice enters through a funnel at one end and, passing through the machine, the friction against the ribs removes the outer cuticle and much of the gluten layer of the grain, together with the germ. The material next passes through screens and fans, where the bran or meal is removed from the clean grain. The latter is now ready for the final process—polishing, which is necessary to give the grain the pearly lustre so much desired. This is effected by rotating the rice in cylinders of wood and wire gauze whose surface is covered with pieces of moose hide or sheepskin, tanned and worked to a high degree of softness. In the polishing the powdery film of gluten and starch cells, visible on the grain after removing the bran, is rubbed off, and the fine flour thus obtained constitutes rice polish. From the polishers the rice goes to the separating screens, with meshes of different size, where it is separated into its appropriate grades.

YIELD OF PRODUCTS.

Dr. S. A. Knapp, in his "Report on Rice Culture" (Bulletin 22, U. S. Dept. Agriculture, Division of Botany), gives the following results from two rice mills; the figures show pounds of products per barrel of 162 pounds:

GRADE.	Mill 1,200 barrels daily capacity. Best lot. Pounds.	Mill 1,200 barrels daily capacity. Poorest lot. Pounds.	Mill 200 barrels daily capacity Best lot. Pounds.	Mill 200 barrels daily capacity Poorest. Pounds.
No. 1, or head rice (unbroken grains	91.32	——	60.00	——
No. 2, or broken rice	15.30	59.82	30.00	60.00
Brewers' rice, very broken,	6.28	3.78	10.00	15.00
Bran	20.00	40.00	25.00	35.00
Polish	8.00	46.00	5.00	8.00
Hulls	21.10	42.40	32.00	44.00
	162.00	162.00	162.00	162.00

ANALYSES OF RICE PRODUCTS.

Very complete analyses of the various products of the Louisiana rice industry were made in 1889 by Prof. B. B. Ross. The results of his work are given in the following table, which is taken from Bulletin No. 24.

ANALYSES OF RICE PRODUCTS. (Ross.)

SAMPLE.	Water	Ash	Fat	Crude Fiber	Crude Protein	Carbohydrates	Total Nitrogen	Albumenoid Nitrogen	True Protein
1. Rough rice	10.95	5.45	2.58	9.28	7.44	64.30	1.19	1.134	7.09
2. Rice from the stones	12.12	2.55	2.10	3.03	8.09	72.11	1.295	1.295	8.09
3. Pounded rice	12.42	2.38	2.50	2.55	8.14	72.01	1.30	1.274	7.96
4. Bran	10.67	11.00	9.97	10.95	11.29	46.02	1.806	1.708	10.67
5. Rice from cooling floor.	12.75	0.82	1.05	0.72	7.74	76.92	1.24	1.19	7.44
6. Polish	10.63	5.45	7.02	2.62	10.94	63.34	1.75	1.736	10.85
7, Clean rice	12.85	0.73	0.38	0.47	7.52	78.05	1.204	1.143	7.17
8. Hulls	8.27	13.85	0.85	38.15	2.89	34.99	.46	.46	2.89
9. Straw	8.97	19.97	1.87	32.25	4.72	32.21	.756	.756	4.72

Analyses of various rice products from Louisiana rice mills, made during the past year at the Sugar Experiment Station, by Browne and Chiquelin, are also given:

ANALYSES OF RICE PRODUCTS. (Browne and Chiquelin.)

SAMPLE.	Water	Fat	Ash	Protein	Crude Fiber	Carbohydrates	Starch	Pentosans
Rice straw	10.84	0.59	14.04	3.81	33.91	35.31	.....	15.84
Rice hulls	8.87	0.41	18.29	3.50	41.89	27.86	.....	17.24
Rice meal (pure bran, no hulls or grits)	8.57	14.20	3.73	13.41	9.51	49.43	18.80	.....
Rice bran (16 per cent. hulls, 28 per cent grits)	9.84	9.91	11.53	9.88	14.70	44.20	25.42	8.05
Rice bran*	10.01	9.03	8.07	9.20	11.00	52.03	.....	.....
Rice polish (22 per cent. grits)	11.83	5.92	3.45	11.06	3.76	63.97	54.82	3.46
Rice polish*	10.79	6.95	2.95	8.53	1.80	69.14	.....	.....
Raw rice	.....	.....	.....	9.85	.....	.....	69.67	2.14
Polished rice	.....	.....	.....	6.56	.....	.....	77.55	.....

*Samples from rice mills at Crowley, La., hulls and grits not determined.

Varying amounts of hulls and grits are found in the commercial bran and polish, so that these products never possess a fixed composition.

Very complete analyses of products from the South Carolina rice mills have been made by C. C. McDonnell of the South Carolina Agricultural Experiment Station. (Bulletin No. 59, 1901.)

The utilization of rice straw and rice hulls as stock for paper-making has been proposed. Rice straw and hulls are largely composed of cellulose, lignin, and pentosans or gum. The lignin and pentosans (mostly xylan with a little araban), are largely removed in the preparation of paper pulp by digesting with alkalies, leaving an impure cellulose. This cellulose may be further purified by bleaching. The percentage of bleached pulp (dried) obtained from rice straw and rice hulls is: Straw, 44.21 per cent, and hulls 43.09 per cent. The ash constituents of the hulls and straw were almost completely removed, leaving a pulp well adapted for paper stock.

THE FEEDING VALUE OF RICE PRODUCTS.

The rice feeds, as they are sold in Louisiana, may be divided into four general classes—rice hulls, rice meal, rice polish and commercial rice bran.

1. Rice Hulls, which are sold either in the coarse condition or ground. In the latter form they are marketed usually as "husk meal" or "star bran." Considerable quantities of this product are exported to Germany. As a stock food they have absolutely no feeding value, and are, in fact, injurious, as will be shown.

2. The Rice Meal.—This is the pure bran, and properly speaking, should be so designated. It is the most nutritious of the rice feeds, containing the most protein and fat.

3. The Rice Polish.—This contains less fat and protein than the meal, but a higher percentage of starch. In addition to its use as a cattle food, rice polish has been employed to some extent as a stuffing material in the manufacture of sausage. A considerable part of the polish made in this country is exported to Germany, where it is used in large quantities for manufacturing buttons. Paraffin, and also powdered talc, have been employed in connection with the polishing of rice. The fear of a possible

contamination with such polishing agents, and the occasional finding in the polish of fragments of wire, broken off from the screens and brushes, have produced in some instances a prejudice against the use of rice polish as a feeding material.

4. Commercial Rice Bran.—What is usually sold under the name of rice bran in Louisiana, is a mixture of the pure bran with varying amounts of hulls, the quantity of the latter being sometimes as high as 70 per cent.

RICE HULLS AND THEIR FEEDING VALUE.

An inspection of the analyses of rice hulls given in preceding tables shows that these have but a low percentage of protein and fat, and that the percentage of woody matter is high. In addition to that the tissues of the hull are heavily impregnated with insoluble silica (12.15 per cent), which renders the work of digestion very hard. But a greater objection to rice hulls for feeding purposes is the element of danger which attends their use. The hull of the rice is not only itself very coarse and rough, but the hard silicified fibers, which make it up, are exceedingly harsh and sharp (See Fig. 1 above), so that when the hulls are eaten in any quantity an intense irritation is provoked in the delicate membranes which line the stomach and intestinal tract.

An interesting case illustrating the danger resulting from feeding rice hulls recently came to light in Stamford, Texas. Swenson Bros., large feeders of cattle, attempted to use rice hulls to supply part of the roughage, and immediately began to be troubled with their animals vomiting. A considerable correspondence took place between these feeders and Dr. Stubbs in regard to the matter. The following summary of the case is given: Swenson Bros., finding that the vomiting did not cease, sent on samples of the vomit and excreta from the sick animals. Dr. Dalrymple, veterinarian of the Experiment Station, made an examination of these, and reported as follows:

Veterinary Department, State Experiment Station,
Baton Rouge, La., March 24, 1903.

Dr. Wm. C. Stubbs, New Orleans, La.:

My Dear Sir—The specimens of feces and vomitus were received this morning, both of which I examined. I noticed that some of the rice hulls in the vomitus were still stiff and pointed, although they had been in this moist material, and which is still very moist, ever since it came from the stomach. In the dried specimen of feces they were, of course, as hard, I should say, as before they were partaken of by the animal. There appeared to be a great quantity of the hulls intact, which would indicate that they had escaped mastication, which condition shows up well in the feces, where one would think they ought to have been in much finer division after having undergone a second mastication. I took some of the hulls between my finger and thumb, pressing lengthwise on the hull, and the ends pricked almost like a needle. Of course, when first swallowed, the hulls would be much more irritating to the delicate stomach walls. Taking the history of the case, as given by Swenson Bros., and if you cannot suggest any chemical irritant in the mass of food material, as a whole, I believe the most feasible diagnosis would be, as stated in my previous communication, gastric irritation produced mechanically by the hard, fibrous and pointed condition of the hulls, due to their being swallowed in that condition, and not sufficiently reduced and softened to prevent their irritating effect upon the delicate nerve filaments in the mucous membrane in the gastric walls. Very respectfully,

W. H. DALRYMPLE.

Swenson Bros. reported that several bulls died during the feeding of rice hulls. In dissecting one of these the paunch was found distended with rice hulls, although none had been eaten in two weeks. In cases where hulls were omitted from the feed the vomiting of the animals ceased.

THE ADULTERATION OF RICE BRAN WITH RICE HULLS.

The experience of Swenson Bros., just recorded, is of especial value as illustrating the dangerous effects of feeding rice hulls; yet these hulls are constantly being fed throughout the South, in many cases probably without its being known. The hulls, which are separated first of all in the process of milling, are frequently ground up and then incorporated with rice bran, or else sold as a filler to other parties, who, no doubt, employ them in the manufacture of the various mixtures now sold everywhere as commercial stock feeds. Our feeders cannot be cautioned too strongly against these brands of mixed feeds, as all sorts of refuse and miller's waste frequently enter into their composition. The best plan is always to buy pure unmixed feeds, and when mixing is to be done, do it yourself.

The practice of mixing hulls and rice meal, which is really the most nutritious portion of the rice for feeding, should therefore be discouraged. Even as a matter of economy, aside from all other objections, feeds adulterated with hulls should not be purchased. Although the direct cost per ton of the adulterated feed may seem less, the feeder is really paying proportionately much more for the amount of nutriment actually received than he would pay if the pure feed had been bought. It should be stated, however, in this connection, that it has been found impossible thus far in the milling of rice to manufacture a bran or meal absolutely free from hulls. Small quantities of the latter work their way into the bran unavoidably, and this seems to be particularly true of the more modern processes of milling, where "hulling" machines are used instead of the old "pounders."

It is highly desirable that some standard be established for rice bran that purchasers may be protected against an unscrupulous adulteration of the product with hulls. A maximum percentage should be set for the quantity of hulls considered unavoidable in the milling process, and all brans exceeding this maximum should be regarded as adulterated. The amount of hulls that may work their way into the bran seems to vary somewhat with the quality of the rice; in the opinion of some rice millers, 10 per cent of hulls would be a very safe maximum to allow. Samples of good rice bran by the new process, analyzed at the Louisiana Station, were found to contain only about 5 per cent hulls, so that 10 per cent would seem to be a liberal allowance.

Judging from the results of reliable analyses, rice bran should contain at least 12 per cent protein and 12 per cent fat, though an excessive amount of grits or broken rice might reduce these figures. In fixing a standard more stress should be laid, therefore, upon the maximum of fiber and ash. Rice bran exceeding 10 per cent fiber or 9 per cent ash should be regarded with suspicion. These limits are suggested, however, only tentatively, as the analyses of many samples from different mills is necessary before a standard can be fixed.

The analyses of a number of adulterated rice brans, analyzed at the Audubon Park Experiment Station, are given in the following table:

ANALYSES OF ADULTERATED RICE BRANS.

SAMPLE.	Moisture........	Fat...........	Ash...........	Protein.........	Fiber..........	Carbohydrates...	Per cent. hulls added.........
1	8.70	11.00	14.39	9.13	20.84	35.94	36.1
2	9.82	4.58	14.29	6.32	31.36	33.63	71.2
3	10.04	10.60	9.27	10.00	17.49	42.60	25.0
4	9.14	11.52	7.89	11.14	13.38	46.93	11.3
5	8.34	13.50	11.36	11.98	11.67	43.25	5.6
6	9.65	10.38	11.38	9.34	14.41	44.84	14.7
7	.....	.....	13.32	10.12	17.45	.....	25.0

The formula employed for calculating adulteration is—

Per cent hulls = 3.33 × (per cent fiber — 10.)

The above formula assumes 40 per cent fiber for pure hulls and 10 per cent fiber for pure bran.

Calculations of adulteration from the increase in percentage of ash are not always trustworthy, as the amount of ash seems to vary in different products, being dependent upon location (upland or lowland), and also upon the degree of irrigation. The adulteration with hulls calculated from the diminution in fat or protein content of the bran would be erroneous in case a large amount of rice grits were present.

Various simple methods are in use among feeders for the detection of hulls in rice bran. If the hulls are not too finely ground, they may be separated together with the grits, by passing the bran through a fine sieve. Stirring the bran up in a glass of water is a method sometimes employed, the amount of floating material being taken as an index of the extent of adulteration, but this is not very reliable as the hulls have a greater tendency to sink than to float. Determination of fiber by chemical analysis is the only reliable means of detecting adulterations with hulls.

GRITS IN RICE FEEDS.

Reference has been made to the presence of grits or broken grains of rice in rice bran and rice polish. In some cases 25 per cent of the feed consists of grits, the varying amounts of these in the rice feeds naturally causes a fluctuation in the composition, a large quantity of grits causing an increase in starch and a decrease in protein and fat. While the grits have a high feeding value, and are not particularly detrimental to the animal, as is the case with rice hulls, it must be noted that many of them pass through the animal undigested. These fragments of rice are very hard to break up and are not easily affected by the digestive juices of the animal. Nearly 10 per cent of the dry matter in the excrement of an animal fed with polish consisted of undigested grits. If these grits could be ground up, or if they could be removed during milling, the digestibility of the feed would be increased. Information has been received that it is even poor economy for the miller to allow the grits to escape into his feeds; that he can sell the grits as brewers' rice for $40 a ton, whereas rice polish brings him but $20, and rice bran considerably less.

RANCIDITY OF RICE FEEDS.

Frequent complaints have been reported in connection with the use of rice feeds, as to their being unpalatable. In some of our own experiments at Baton Rouge, Prof. Dodson reports that animals would not eat rice bran well at first, but had to be coaxed by first mixing in a little cotton seed meal. Reports from the North Carolina Experiment Station, and elsewhere, also show that rice bran is not always relished, it being so distasteful at times that animals will not eat it unless driven by hunger. Lack of palatability in a feed is, of course, a serious drawback to its use; we have, accordingly, made at the Experiment Station an investigation as to the causes of the distaste which animals sometimes show to the various rice feeds. Our experiments show that the trouble consists in a breaking up of the rice oil, which is so abundant in these feeds (over 14 per cent. in pure bran) into free fatty acids, the latter giving the feed a very rancid taste. In some cases we found the rice oil to be nearly 90 per cent. free acid, this amounting to from 8 to 12 per cent. free acid in the feeds themselves. Fresh bran shows only a very low degree of rancidity, but on standing in a sack for some weeks the free acid was found to increase very rapidly. In large bulks this development of rancidity seems to be attended by the feed heating and caking. The cause of this decomposition of the rice oil was traced to a ferment or enzyme, *lipase,* which occurs naturally in the rice, as well as in many other seeds of plants, and has the property of splitting up the vegetable oil into glycerine and free fatty acids. This decomposition does not occur except during germination, or when the seeds are crushed. By subjecting the bran to a heat of 200 degrees Fahrenheit this ferment is destroyed.

The results of some experiments upon the rancidity of oil in rice products is given below. The effect of heating rice bran as a means of preventing rancidity is also shown:

	Per cent. Free Fatty Acids in Oil.
Oil from very rancid rice bran	83.5
Oil from rancid polish	47.5
Oil from raw rice	6.9
Oil from fresh bran, 6 hours after milling	12.5
Oil from above bran, 1 month old, unheated	62.2
Oil from above bran, 1 month old, heated	24.0

The unheated bran turned very rancid; this change went on very slowly in the heated sample, and the slight increase observed was due probably to the natural oxidation which all oils and fats undergo on exposure to the air. If our millers could subject their bran as soon as it is made to a dry heat of 200 degrees Fahrenheit, or even higher, as is done sometimes in the kiln drying of various feeds, and then press the material into cake form, we believe all dangers of rancidity would be removed. A similar process is employed in the preparation of cotton seed and linseed cake, and these feeds, so far as known, are not affected with rancidity. Feeds pressed into cake form are also most conveniently adapted to transportation.

EXTRACTION AND UTILIZATION OF RICE OIL.

Another means of preventing rancidity in rice bran consists in removing a part of the oil. The percentage of oil in rice bran is very high, being double that found in wheat or corn bran. This large percentage of oil is considerably in excess of that required for general feeding purposes, so that an extraction of a considerable part of the oil from rice bran would remove not only the danger of rancidity, but increase the feeding value of the product, it being a well known fact that excess of fat in a feed decreases the digestibility of the protein and other constituents. The rice oil thus removed would have a considerable commercial value, so that the process of extraction would be a source of profit, rather than an item of expense. Complaints as to the laxative effects of rice bran when fed to animals in large amounts, are, no doubt, due to the excess of rice oil, and this difficulty would also be obviated by reducing the amount of oil in rice bran down to two or three per cent.

The Experiment Station at Audubon Park is at present conducting a series of co-operative experiments with an oil company upon the extraction and utilization of rice oil, studying particularly the question as to what extent the character of the rice bran is thus improved.

DIGESTION EXPERIMENTS WITH RICE BRAN AND RICE POLISH.

In these experiments three steers were used, the care of the feeding details being under the supervision of Prof. W. R. Dodson at Baton Rouge. Results are reported for only two of the steeers, as one of the animals did not eat well during the experiment, besides manifesting other irregularities. The animals were fed in each experiment unmixed rations. While the feeding of pure bran or of pure polish, without roughage, to stock would never be advisable, it was done in the experiments for the reason that a more accurate knowledge of the digestibility of certain constituents of the rice feeds could be secured, than where a mixed ration was fed. The digestibility of mixed rations, containing rice bran or meal, will be the object of future experiments.

EXPERIMENT WITH RICE BRAN.

The rice bran used in the experiment was purchased as a pure article, but was found on analysis to contain about 16 per cent. of hulls; 25 per cent. of grits were also present. The steers manifested a dislike to the feed at first, due probably to the fact that it was rancid. By coaxing the animals with a little cotton seed meal mixed with the bran, this dislike was somewhat, though not entirely, overcome.

On January 26, the feeding of the bran began; a little cotton seed meal and hay were also given. On February 2 the animals were eating fairly well and the hay and cotton seed meal were dropped. February 5 the steers were put in the stalls, where they were kept for twelve days; they were fed twice daily, at 6 a.m. and 6 p.m. During the last six days of the period the feces from each animal were collected at regular intervals and an aliquot sample drawn for analysis. At the end of the experiment the daily samples were thoroughly mixed and a sample from this composite was sealed up in a jar, after addition of a little preservative. Samples of the bran were also taken, a small portion being drawn at each feeding.

All samples were sent to the Experiment Station laboratory at Audubon Park, where the analyses were made.

COMPOSITION OF RICE BRAN—EXPERIMENT 1.

	Steer Bob. Per cent.	Steer Buck. Per cent.
Moisture	9.96	9.84
Fat	9.88	9.91
Protein	9.88	9.88
Ash	11.23	11.35
Fiber	14.30	14.76
Carbohydrates (Nitrogen free extract)	44.75	44.26
	100.00	100.00
Albuminoids	9.00	9.00
Pentosans	8.95	8.95
Starch	25.42	25.42

COMPOSITION OF FECES—EXPERIMENT 1.

	Steer Bob. Per cent.	Steer Buck. Per cent.
Air dry matter	27.30	28.95

PERCENTAGE COMPOSITION OF AIR DRY FECES.

	Steer Bob. Per cent.	Steer Buck. Per cent.
Fat	11.09	11.56

Moisture	3.87	3.94
Protein	8.63	9.06
Ash	20.16	18.23
Fiber	32.65	31.36
Carbohydrates (Nitrogen free extract)	23.60	25.85
	100.00	100.00
Albuminoids	7.63	8.75
Pentosans	14.35	15.79

The coefficients of digestibility of the rice bran, calculated from the above analyses, are as follows:

TABLE I.

STEER BOB.

	Total amount, ounces	Dry matter, ounces	Fat, ounces	Protein, ounces	Ash, ounces	Fiber, ounces	Carbohydrate (N. free ext.)	Albuminoids, ounces	Pentosans, ounces
Rice bran fed six days	1309.0	1178.6	129.3	129.3	146.5	187.2	585.8	117.8	117.1
Feces, six days	1809.0	474.8	54.9	42.6	99.6	161.3	116.6	37.7	70.8
Digested	......	703.8	74.4	86.7	46.9	25.9	469.2	80.1	46.3
Per cent. digested	......	59.7	57.5	67.0	32.0	13.8	80.1	68.8	39.5
STEER BUCK.									
Rice bran fed six days	1796.5	1619.7	178.0	177.5	203.9	265.2	795.1	161.7	160.8
Feces, six days	2550.0	709.4	85.4	66.9	134.6	231.6	190.9	64.6	116.6
Digested	......	910.3	92.6	110.6	69.3	33.6	604.2	97.1	44.2
Per cent. digested	......	56.2	52.0	62.3	34.0	12.7	76.0	60.0	27.4
Av. 2 steers, pct. dig.	......	58.0	54.8	64.7	33.0	13.3	78.1	64.4	33.5

The animals lost a little in weight during the experiment with rice bran, as is shown from the following record:

	Steer Bob.	Steer Buck.
Weight at beginning of experiment	1,280 lbs.	1,440 lbs.
Weight at close of experiment	1,250 lbs.	1,430 lbs.

EXPERIMENT WITH RICE POLISH.

The rice polish used in the experiment was a good quality of the commercial article. It was comparatively free from hulls, but contained about 23 per cent. of grits or broken grains. The feed was slightly rancid, but the animals seemed on the whole to relish it better than the bran.

The steers were first fed on the polish March 6, when they were still running in the pasture. March 7 they were taken up, and not put on grass again, but could graze a little in the lot. Some cotton seed meal was added to the polish till March 10. On March 11 they were put in the stalls and allowed nothing to eat but the rice polish, receiving five pounds at each feed, night and morning, for twelve days. Collections of samples of feed and feces were made during the last six days, as in the previous experiment.

COMPOSITION OF THE POLISH—EXPERIMENT 2.

	Steer Bob. Per cent.	Steer Buck. Per cent.
Moisture	11.19	11.83
Fat	5.67	5.92
Protein	11.13	11.06
Ash	3.52	3.46
Fiber	3.88	3.76
Carbohydrates (Nitrogen free extract)	64.61	63.97
	100.00	100.00
Albuminoids	11.00	10.88
Starch	54.82	54.82
Pentosans	3.46	3.46

COMPOSITION OF FECES—EXPERIMENT 2.

	Steer Bob. Per cent.	Steer Buck. Per cent.
Air dry matter	27.30	26.27

PERCENTAGE COMPOSITION OF AIR DRY FECES.

	Steer Bob. Per cent.	Steer Buck. Per cent.
Moisture	3.80	3.20
Fat	6.63	12.78
Protein	24.00	23.63
Ash	15.79	14.08
Fiber	18.88	18.70
Carbohydrates (Nitrogen free extract)	30.90	27.61
	100.00	100.00
Albuminoids	23.25	22.56
Starch	5.78	1.73
Pentosans	9.57	10.86

The coefficients of digestibility of the rice polish, calculated from the above analyses, are given in the following tables:

TABLE II.

STEER BOB.

	Total amount, ounces.	Dry matter, ounces.	Fat ounces.	Protein, ounces.	Ash, ounces.	Fiber, ounces.	Carbohydrates (N.fr.ex.), ounces.	Albuminoids, ounces.	Pentosans, ounces.	Starch ounces.
Rice polish fed 6 days	960	852.6	54.4	106.8	33.8	38.2	620.3	105.6	29.5	526.3
Feces, 6 days	574	150.7	10.4	37.6	24.7	29.6	48.4	36.4	15.0	9.1
Digested	....	701.9	44.0	69.2	9.1	8.6	571.9	69.2	14.5	517.2
Per cent. digested..	....	82.3	80.9	64.8	26.9	22.5	92.2	65.5	49.2	98.2

STEER BUCK.

	Total amount, ounces.	Dry matter, ounces.	Fat ounces.	Protein, ounces.	Ash, ounces.	Fiber, ounces.	Carbohydrates (N.fr.ex.), ounces.	Albuminoids, ounces.	Pentosans, ounces.	Starch ounces.
Rice polish fed 6 days	960	846.4	56.8	106.2	33.2	36.1	614.1	104.4	29.5	526.3
Feces, 6 days.......	576	146.5	19.3	35.8	21.3	28.3	41.8	34.1	16.4	2.6
Digested	....	699.9	37.5	70.4	11.9	7.8	572.3	70.3	13.1	523.7
Percent. digested...	....	82.7	66.0	66.3	35.8	21.6	93.2	67.3	44.4	99.5
Av. 2 steers, pct. dig.	....	82.5	73.5	65.6	31.4	22.1	92.7	66.4	46.8	98.9

The animals lost again in weight during the feeding with rice polish, but this loss was due largely to the fact that the animals were drinking a great deal less water at the close of the experiment.

	Steer Bob.	Steer Buck.
Weight at beginning of experiment....	1,240 lbs.	1,445 lbs.
Weight at close of experiment........	1,220 lbs.	1,400 lbs.

At the beginning of the experiment the steers were drinking from 40 to 45 pounds of water per day, and at the close only from 18 to 20 pounds.

EXPERIMENTS ELSEWHERE UPON RICE FEEDS.

The results of a few experiments performed elsewhere upon the digestibility of rice bran and rice meal is given below:

TABLE III.

AUTHORITY.	Feed........	Number Trials..	DIGESTION COEFFICIENTS.					
			Dry Matter...	Fat........	Protein......	Ash........	Fiber........	Carbohydrates
Emery, N. C. Station, Bull. 160..........	Rice Bran.	2	64.7	88.6	62.9	2.4	29.2	78.2
Lindsey, Mass. Station Rep. 1896, p. 135	Rice Meal.	1	74.0	91.0	62.0	....	......	92.0
German Reports........................	Rice Meal.	12	73.0	85.0	63.0	....	26.0	86.3

DISCUSSION OF RESULTS UPON DIGESTIBILITY OF RICE BRAN AND RICE POLISH.

DIGESTIBILITY OF DRY MATTER.

Comparing the bran with the polish we note from Tables I. and II. that the percentage of dry matter digested from the latter is about 25 per cent. greater. The high percentage of hulls in the bran (about 16 per cent.) explains this fact, the large amount of insoluble silicious matter in the hulls rendering them practically indigestible. Eliminating the mineral matter and calculating the digestive coefficients to organic matter alone, we obtain the following results:

	Rice Bran.	Rice Polish.
Per cent. of organic matter digested—Bob....	63.6	84.6
Per cent. of organic matter digested—Buck...	59.4	84.6
Average	61.5	84.6

This still shows a difference of 23 per cent. in favor of the polish. The dry matter of the polish containing about 30 per cent. more starch than that of the bran would naturally have a greater digestibility.

The feces of the animals fed on bran was made up to a large extent of undigested hulls very little broken or reduced during the process of mastication and digestion.

DIGESTIBILITY OF RICE OIL.

The steers were able to digest a much higher percentage of fat from the polish than from the bran. This may have been due to the fact that the animals received in the polish experiments only about one-third the quantity of fat given during the feeding with bran and were thus able to digest a greater percentage from the rations. The fat in the bran was also much more rancid than that in the polish, and this may have affected its digestibility to some extent.

	Free Fatty Acids.
Rice oil from bran	83.5 per cent.
Rice oil from polish	47.5 per cent.

The excess of the hulls in the bran may also have lessened the digestibility of the fat.

Individuality of the animal seemed to play a considerable part in the digestion of the fat. With the polish the steer Bob was able to digest 15 per cent. more of the fat than Buck. In the case of the latter animal about 13 per cent. of the dry feces consisted of undigested fat.

It was found in the determination of fat in the feces that the customary extraction with ether, according to the method of the Association of Agricultural Chemists, did not effect in every case a complete removal of the fat. It was only after digesting the feces with pepsin solution, to remove the excess of albuminoid products, and then filtering off and drying the residue, that a satisfactory extraction could be made.

PER CENT FAT IN AIR DRY FECES.

Method of Analysis.	Bran Experiment.	Polish Experiment.
Steer Bob—		
Ordinary method, 20 hours extraction	11.09	6.19
Pepsin method, 20 hours extraction	11.12	6.63
Steer Buck—		
Ordinary method, 20 hours extraction	9.80	8.87
Ordinary method, 24 hours extraction	——	8.94
Ordinary method, 32 hours extraction	——	10.00
Pepsin method, 20 hours extraction	11.56	12.78

The greater amount of fat obtained after digesting the feces with pepsin is very marked for the steer Buck. Beger (Chemiker Zeitung, 1902, 26, No. 11) has called attention to the necessity of employing the pepsin method in determining fat in various materials, and the same necessity would appear to exist in the analysis of some kinds of feces. The feces of the animals were very glutinous and several per cent. of proteid matter was removed by the pepsin treatment. A mechanical occlusion of fat by albuminoid matter is the probable explanation of the difficulty experienced in making a direct extraction with ether.

The chemical composition of rice oil, and the changes which it undergoes through digestion, were studied to some extent. The following table shows a few of the chemical and physical constants of the fat obtained from rice bran and of that extracted from the feces of the steers fed upon the same:

99°	Fat from Rice Bran.	Fat from Feces.
Specific gravity 99°	0.8907	......
Melting point	24°C.	
but not perfectly melted until	47°C.	58°C.
Acid number	166.2	144.2
Saponification number	193.5	176.0
Ether number	27.3	31.8
Iodine number	91.65	27.08
Volatile acid number (2.5 gm.)	1.1	......
Mean molecular weight of insoluble fatty acids	289.3	320.2
Melting point of fatty acids	36°C.	60°C.

The rice fat in winter weather consisted of a semi-solid pasty mass, but in summer had melted to a clear brownish colored oil with a deposit of solid crystallized fats. The fat from the feces was firm and solid.

The results show that rice fat is not a simple substance, but a mixture of different fatty bodies, some of which are liquid, containing unsaturated compounds, similar to olein or oleic acid, while others are solid; the fatty acids occurring in rice oil vary also in complexity, some of them being of low and others of high molecular weight.

A comparison of the figures for the rice oil and the oil from the feces shows very marked differences; without entering into a detailed interpretation of these, the results show that the liquid portion of the fat and the compounds of lowest molecular weight are the most easily assimilated. The fat from the feces, compared with that from the bran, has over 60 per cent. less of the unsaturated or liquid constituents and a much greater percentage of the fats of high molecular weight, which, owing to the resistance they offer to emulsification, have escaped assimilation. The molecular weight of stearic acid, the highest fat in the animal body, is 284;

solid fatty acids of greater molecular weight than this are assimilated in the animal probably only to a very limited extent.

DIGESTIBILITY OF PROTEIN.

Comparing the rice bran with the polish there appears to be but little difference between the digestion coefficients of protein. The results also agree very closely with the values, determined by other investigations, for rice bran and rice meal, as shown in Table III. Compared, however, with the results obtained by an artificial digestion of the rice bran and polish with pepsin solutions, the digestion coefficients of protein in Tables I. and II. are exceedingly low.

TABLE IV.

ARTIFICIAL DIGESTION OF RICE BRAN AND RICE POLISH.

	Rice Bran. per cent	Rice Polish. per cent
Protein in original feed	9.88	11.13
Protein in residue after digesting with pepsin solution 48 hours	1.63	1.09
Protein dissolved by pepsin	8.25	10.04
Percentage protein dissolved by pepsin	83.5	90.2
Average digestion coefficient of protein	64.7	65.6
Excess of protein digested by pepsin	18.8	24.6

The above results would indicate either an imperfect digestion of the protein of the feed on the part of the steers, or the presence in the feces of proteid matter, sluffed off from the walls of the intestines during digestion. Such substances resulting from the wear and tear on the digestive organs are usually termed "metabolic" products.

The following experiments were made by artificial digestion with pepsin solution, to determine whether any digestible proteid matter was present in the feces of the steers fed on rice bran and polish:

	Bran Experiment.		Polish Experiment.	
	Bob.	Buck.	Bob.	Buck.
	per cent.	per cent	per cent.	per cent.
Protein in undried feces....	2.38	2.63	5.60	5.86
Protein in undried feces after digestion with pepsin 48 hours	1.36	1.28	3.11	3.39
Protein removed by pepsin..	1.02	1.35	2.49	2.47
Per cent of protein in feces digestible by pepsin.....	43.53	51.33	44.46	42.15

The results show a surprisingly large amount of digestible protein in the feces of the steers. This may come, as has been indicated, either from the feed or from the animal body; more probably it comes from both. While there is no satisfactory method, as yet, for differentiating between these sources of the digestible protein left in the feces, it is very evident that the digestive coefficients of protein, as commonly determined are much too low and that some correction should be made.

If we recalculate the digestion coefficients of protein in the experiments by correcting for the digestible protein in the feces, the following results are obtained:

	Bran Experiment.		Polish Experiment.	
	Bob.	Buck.	Bob.	Buck.
	Oz.	Oz.	Oz.	Oz.
Protein in feed 6 days.....	129.3	177.5	106.8	106.2
Protein in feces, 6 days after deducting protein soluble in pepsin sol............	24.5	32.6	17.9	19.5
Digestible protein	104.8	144.9	88.9	86.7
Percentage digestible of protein	81.1	81.6	83.2	81.1

The above corrected coefficients for digestible protein are nearly 20 per cent higher than those given in tables I and II, but are still somewhat lower than the values found by artificial digestion in Table IV. The excretion by the animal of metabolic nitrogenous compounds, insoluble in pepsin, such as nuclein, no doubt accounts for the lower results.

It is still a question whether the method of an artificial digestion does not give more accurate results for the actual digestibility of protein in a ration, than an experiment with an animal. While it is not a test under perfectly natural conditions, the method can be perfectly controlled, and is not open to the many sources of error that are encountered in experiments with animals.

DIGESTIBILITY OF FIBER AND CARBOHYDRATES.

Among the carbohydrates of feeding materials are included a number of bodies, the principal ones being the *sugars, starch,* and the *gums,* or *pentosans,* these latter accompanying the fiber, together with the various bodies of a woody nature grouped together under the name *lignin.* The sugars and starch of a ration are very completely digested, the pentosans, fiber, and lignin bodies only imperfectly so.

The rice bran, as was stated, contained over 16 per cent rice hulls, which, owing to their woody nature, are rich in fiber, pentosans and lignin; the rice polish was comparatively free from hulls, but contained instead a large quantity of starch. These facts readily explain the greater digestibility of the carbohydrates in the polish. The fiber and pentosans are both less digestible in the bran, due to the fact already explained that the large amount of silica in the hulls decreases their digestibility.

The varying quantities of grits, or broken grains of rice in the bran and polish causes, naturally, a variation in the amounts of carbohydrates present and influences also to some extent the digestibility of the same. The statement has been made by some authorities that the sugar and starch of a ration are completely digested; this statement requires some modification, for while it may be true of materials fed in a fine condition, it is by no means the case when animals are fed whole grain, or grain only roughly ground. In the feces of the steers, both in the bran and in the polish experiment, there were found many undigested grits, these varying in size from microscopic particles, to whole rice grains. The feces, after reducing the grits in a mortar, all gave strong starch reactions with iodine. In the case of the polish it was calculated from the amount of starch in the feces of one of the animals that about 7 per cent of the grits in the feed escaped digestion. The digestion coefficients of the starch in the polish experiment are given in Table II.

COMPARISON OF RICE BRAN AND POLISH WITH OTHER CEREAL FEEDS.

The percentage of digestible nutrients in the rice bran and polish, as calculated from the tables of composition and digestibility previously given, appears below. The composition of a few other cereal feeds is also given for comparison. Digestible fiber is included in the carbohydrates:

PRODUCT.	DIGESTIBLE.					Total Indigestible Per Cent.......
	Protein—Per Cent........	Fat—Per Cent	Fiber—Per Ct	Ash—Per Cent	Carbohydrates Per Cent....	
Rice Polish..............	7.26	4.36	0.83	1.09	59.30	27.16
Rice Meal..............................	8.80	10.50	2.50	3.80	42.00	32.40
Rice Bran (16 per cent hulls)........................	6.37	5.43	1.96	3.74	34.57	47.93
Rice Straw..............................	1.50	0.28	16.00	4.63	22.25	55.34
Rice Hulls..	0.80	0.23	5.57	5.40	8.60	79.40

COMPARISON OF DIFFERENT RICE PRODUCTS IN DIGESTIBILITY.

In the following tables the percentages of digestible ingredients and indigestible matter are given for the different rice products, which are arranged in the order of their digestibility. The figures for *Rice Meal* and *Hulls* are estimates based upon the experiments with the bran and polish. The figures for Rice Straw are taken from tables by Dietrich & Konig:

PERCENTAGE OF DIGESTIBLE NUTRIENTS.

	Protein. Per cent.	Fat. Per cent.	Carbohydrate. Per cent.
Rice bran, (16 per cent hulls)....	6.4	5.4	36.9
Rice polish	7.3	4.4	60.7
Rice meal (i.e., pure rice bran free from hulls), calculated.........	8.8	10.5	42.0
Wheat bran	12.2	2.7	39.2
Wheat middlings	12.8	3.4	53.0
Corn bran	7.4	4.6	59.8
Rye bran	11.5	2.0	50:3
Oat shorts	12.5	2.8	46.9

Rice meal or rice polish contains considerably less digestible protein than any of the other cereal feeds, with the exception of corn bran. The distinguishing characteristics of rice bran when pure, is the large amount of fat, the percentage of this being over twice that found in any other cereal bran.

THE FEEDING OF RICE PRODUCTS TO FARM ANIMALS.

The following remarks in regard to the feeding of rice products apply for the most part to the pure bran or rice meal, this being the pricipal by-product of the milling industry. Rice polish is produced in much less quantity, and at its present high price it is a question whether it is an economical feed for general purposes. It contains less protein and fat than the meal, and there are other cheaper materials, as molasses, which can supply any deficiency our rations may have in carbohydrates, without paying $20 or more per ton for the polish.

Pure rice bran or meal, while not belonging to the higher concentrates, such as cotton seed or linseed meal, which have a high protein content, is excellently adapted as an adjunct to those more concentrated feeds, and in compounding any ration the Southern feeder will find it especially useful.

Rice Bran for Horses or Mules—Rice bran has been fed with considerable success to horses and mules in Louisiana and elsewhere in the South.

A few examples of a mixed ration for horses or mules, introducing rice meal, are given below. Such a ration should contain coarse fodder, such as hay, in addition to the concentrates. The general practice is to use the coarse and concentrated feed in about equal proportions. The following rations ought to meet the needs of an ordinary farm mule, weighing 1,200 pounds, and doing a heavy amount of work:

Ration No. 1—15 pounds crabgrass hay,
8 pounds corn,
8 pounds rice meal,
1½ pounds cotton seed meal.

If leguminous hays are available, these may be used instead of cotton seed meal to supply protein.

Ration No. 2—15 pounds alfalfa hay,
8 pounds rice meal,
2 pounds corn,

8 pounds molasses.
Ration No. 3—15 pounds cow pea hay,
8 pounds rice meal,
8 pounds corn.

The amounts of digestible protein in the above rations approximate 2½ pounds, the amounts of digestible fat and carbohydrates about 15 pounds.

These values exceed somewhat the usual practice of American feeders, but are no greater than the standards accepted in France and Germany, and certainly none too large for plantation mules, which are usually very heavily worked.

The rations given are, of course, only examples, and can be varied in any number of different ways to suit the convenience of the feeder.

Rice Bran for Cows—Comparative experiments at the North Carolina Experiment Station (Bulletin No. 169) in feeding rice bran and wheat bran to dairy cows have demonstrated that rice bran alone, with corn silage as a source of roughage, is inferior to wheat bran, inasmuch as cows lost both weight and milk on the rice ration. Owing to the deficiency of rice bran in protein, it is difficult to make a properly balanced ration for milch cows with this feed alone in connection with some kinds of roughage. Experiments at the above named station (Bulletin No. 169) show, however, that if this deficiency in protein be made up by adding a little cotton seed meal to the ration, there is no difference in the feeding value of rice bran and wheat bran, provided the animals relish the feed equally well, which is not always the case. The distaste which farm animals show at times to rice bran was found in our own experiments to be due to a rancid condition of the feed. Henry states (Feeds and Feeding, page 144) that "rancid rice meal has a bad influence on milk and butter and is apt to disturb the digestion of the cow." The causes of rancidity in rice products and possible remedies therefor have already been dwelt upon.

Rice Bran for Pigs—Rice bran and also rice polish have been used very successfully in Louisiana for feeding and fattening pigs. Experiments by Connor at the South Carolina Agricultural Experiment Station (Bulletin No. 55) show that rice meal fed with skim milk to pigs has a feeding value equal to, if not greater, than that of corn meal. Similar results have been reported by Lindsay, Holland and Billings, at the Massachusetts Hatch Experiment Station (9th Annual Report, 1897, page 126).

Rice bran, owing to its deficiency in protein, should not be fed alone to growing pigs, but with some adjunct such as skim milk or meat scraps.

FERTILIZING VALUE OF THE RICE FEEDS.

An important point in connection with the purchase of feeding materials, is the amount of fertilizing matter which they contain in the form of nitrogen, potash and phosphoric acid. These ingredients are to a large extent all recovered in the manure of the animals, and they therefore contribute in an indirect way to the maintenance of soil fertility. In the following table is given the percentage of different rice products in nitrogen, phosphoric acid and potash, according to analyses by G. C. McDonnell, of the South Carolina Experiment Station, together with the relative commercial value of these per ton of product (Louisiana prices). A few other feeds are also given for comparison:

	Nitrogen. Per cent.	Phos. Acid. Per cent.	Potash Percent.	Commerc'l Value.
Rice straw	.48	.10	1.28	$2.53
Rice hulls	.30	.09	.22	1.03
Rice bran or flour	2.13	3.90	1.50	10.31
Rice polish	1.90	2.50	.94	8.00
Wheat bran	2.67	2.89	1.61	10.91
Wheat middlings	2.63	.95	.63	7.99
Rye bran	2.32	2.28	1.40	9.25
Corn meal	1.58	.63	.40	3.79
Cotton seed meal	6.64	2.68	1.79	20.40

In the following table the percentage of digestible nutriments in some of our common feeding materials are given. These figures have been compiled from various sources and will no doubt be found useful in the compounding of rations for farm animals.

DIGESTIBLE NUTRIENTS IN COMMON FEEDSTUFFS.

Name of Feed.	Protein. Per cent.	Fat. Per cent.	Carbohydrates. Per cent.
Cow pea vine hay	10.8	1.1	38.6

Alfalfa hay (Lucerne)	11.0	1.2	39.6
White clover hay	11.5	1.5	42.2
Red clover hay	6.8	1.7	35.8
Sorghum (green)	0.6	0.4	12.2
Corn fodder	2.5	1.2	34.6
Corn stover (without ears)	1.7	0.7	32.4
Crab grass hay	2.2	0.6	42.8
Johnson grass hay	3.4	1.2	39.8
Oat hay	4.3	1.5	46.4
Oat straw	1.2	0.8	38.6
Wheat straw	0.4	0.4	36.3
Rice straw	1.5	0.3	31.0
Corn silage	0.9	0.7	11.3
Corn, flint grain	8.0	4.3	66.2
Corn, dent grain	7.8	4.3	66.7
Corn and cob meal	4.4	2.9	60.0
Corn cobs	0.4	0.3	52.5
Oats	9.2	4.2	47.3
Wheat bran	12.2	2.7	39.2
Wheat middlings	12.8	3.4	53.0
Rice bran (free from hulls)	8.8	10.5	42.0
Rice polish	7.3	4.4	60.7
Cotton seed meal	37.2	12.2	16.9
Cotton seed hulls	0.3	1.7	33.1
Centrifugal molasses (sugar cane)	2.5	....	70.0

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In the preparation of the foregoing works upon Rice Feeding Stuffs the writer desires to express his indebtedness to Dr. W. C. Stubbs and Prof. W. R. Dodson, the latter having had charge of the feeding experiments and having also prepared microscopic cuts of the rice hull and grain. We also acknowledge courtesies extended by Dr. W. H. Dalrymple. For samples of the various rice by-products, we are greatly indebted to Mr. Henry Kahn, president of the National Rice Milling Company. In the work of analysis very valuable assistance was rendered by Mr. George Chiquelin.

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OF THE

AGRICULTURAL EXPERIMENT STATION

OF THE

Louisiana State University and A. & M. College

WM. C. STUBBS, Ph. D., Director and State Chemist.

Comparative Results of Seedling Sugar Canes, D. 74 and D. 95, with our Home Sugar Canes (Louisiana Striped and Louisiana Purple.)

By Wm. C. Stubbs and R. E. Blouin.

Issued by the Bureau of Agriculture and Immigration,
J. G. Lee, Commissioner.

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and A. & M. COLLEGE.

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LOUISIANA STATE UNIVERSITY AND A. & M. COLLEGE, BATON ROUGE, LA.

Hon. J. G. Lee, Commissioner of Agriculture and Immigration,
Baton Rouge, La.

DEAR SIR—I hand you a bulletin covering the results of our experiments with the D. 74 and D. 95 Seedling Canes compared with our home canes, for the past ten years, and including in it the experiences of a number of our sugar planters with these canes. I ask that this be published as Bulletin No. 78.

Respectfully submitted,

WM. C. STUBBS, Director.

COMPARATIVE RESULTS OF SEEDLING SUGAR CANES D. 74 AND D. 95, WITH OUR HOME SUGAR CANES (LOUISIANA PURPLE AND LOUISIANA STRIPED).

Several years ago, Messrs. Harrison and Bovell of Barbados, in order to determine the fertility of the seed produced by the sugar cane in tasseling. carefully cleaned the ground on the leeward side of a field of cane about to tassel and prepared it to receive such seed as might be blown over by the winds and find a suitable soil to lodge in. In a short while their efforts showed fruit. by finding springing up in the soil grass like sprouts, very small and diminutive, reminding one of spring or June grass. These sprouts were placed in pots and carefully nursed, then transferred to plats, and in this manner quite a number of sugar canes were produced. On maturity a representative stalk of each original plant was analyzed, and those showing any marked promise, by character of growth, sugar content, etc., to merit its further growth were given numbers and planted in experimental plats. From this beginning they were further studied and experiments carried on comparing them with sugar canes giving the most satisfactory results.

Simultaneously with this discovery, Prof. Kobus of the Java experiment station, produced seedling canes from the tassels of sugar cane there, and later fertile cane seed have been obtained there by cross fertilization of the pollen of the wild cane on the pistils of the sugar canes grown there and the seedlings produced.

Since these discoveries, tropical sugar producing countries and islands have produced varieties of sugar canes from seed, termed seedlings; and further from these seedlings have produced other seedlings. By this production of different canes they have succeeded in securing sugar canes of marked superior qualities over the sugar canes grown on their plantations, both in yield per acre and in sugar content.

It is accepted that sugar cane was first produced or is a native of India, and from this cane either by bud variation or from natural seedlings our numerous varieties of sugar canes other than the seedlings of recent origin were produced. This together with climatic variations have given us the large number of sugar canes we have to-day. At the Louisiana Sugar Expriment Station we have secured and experimented with canes from every available cane sugar producing portion of the globe, and had not until the introduction of "seedling canes" found any of those from tropical countries superior to our home canes, Louisiana Purple and Louisiana Striped. In 1893 we secured through the kindness of Profs. Harrison (who had been transferred from Barbados to Demerara) and Jenman of Demerara, a number of "seedling canes" produced by them, and later from Prof. Fawcett of Jamaica, Prof. Hart of Trinidad, and Profs. D'Alberquerque and Bovell of Barbados, this station has been the recipient of a large number of seedlings. Also from Queensland through the Sugar Experiment Station in Honolulu. These canes are designated by numbers and the initial letter of the country where they were originated, as D. No. 74 from Demerara, B. No. 347 from Barbados, T. No. 111 from Trinidad, etc. A large number of these seedlings have been found unworthy of further trial here and have been discarded. Others are still under experiment, and two have been found to have superior merit over our home canes. They are known as D. No. 74 and D. No. 95, and were originated in Demerara.

D. No. 74 is a tall, erect green cane, with long joints, a deep green foliage, long and deep roots, suckers or rattoons abundantly, has a large sugar content; the individual stalks are large and heavy, and has uniformly given a large tonnage, during the ten years which it has been on trial at the Louisiana Sugar Experiment Station. The leaves are upright in growth and adhere closely to the stalk, a condition which should be noted in harvesting, owing to the tendency to top the cane too low. It is a soft cane yielding a very good extraction.

D. No. 95 is a large erect purple cane, lighter in color than our home cane, long joints, a pale green foliage, long and deep roots, suckers or rattoons well, has a large sugar content, and large individual stalks, though not as large as D. No. 74. Its leaves are upright in growth, though not as pronounced as D. No. 74. In harvesting the same precautions should be observed as in D. No 74. A special study of these canes covering the roots, stalks and tops developed the fact that the center of gravity was near the ground, and such is the reason for the erect growth of these canes. In tropical countries both of these canes have been noted for their early maturity, a condition unfavorable with them, but of great advantage to us in Louisiana. Both of these canes are very hardy, having passed through the winters of 1895 and 1899 equally as well, if not better than our home canes, as our records prove, and which will be given later.

The topic of this evening, "The practical results of D. No. 74 and D. No. 95," necessitates a comparison of these canes with our Home Purple and Striped.

Since the introduction of these canes by Dr. Stubbs in 1893, we have carefully followed them in all particulars, and the following are the results. The first crop was obtained in 1894. Only a few stalks were grown owing to the limited supply of the canes received and no tonnage was determined. They were in our nursery rows and only their characteristics in growth and suckering and sugar content were noted. The following is the comparative data for the year of their first growth in Louisiana:

RESULTS OF D. No. 74, D. No. 95, AND HOME CANES FOR 1894.

Variety	Total Solids by Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose Ratio
D. No. 74	15.1	12.2	1.02	1.88	80.8	8.36
D. No. 95	16.7	15.2	.67	.83	91.0	4.40
D. No. 95	16.8	15.2	.74	.86	90.5	4.86
D. No. 95	16.5	14.6	.76	1.14	88.5	5.20
Home Canes	15.3	11.6	2.18	1.52	75.8	18.79

All these analyses were from plant canes. Several analyses of D. No. 95 were made and are here given, owing to its very pronounced superiority in sucrose over any cane grown on the experiment station this year. Other seedlings were tried, the total comprising quite a number and some showing more or less promise, but were on further trial either discarded or placed in our variety plats, to become acclimated and rid themselves of their objectionable features. So far they have not equalled the home canes, and while quite a number are still under experiment, none of the earlier introductions have shown any special merit.

Recent importations of seedlings produced from these seedlings have shown decided promise, but we have not had them long enough to give any comparative data. The following are the comparative field results of D. 74, D. 95 and our Home canes, given annually up to the present time:

1895.

Variety	Brix	Suc.	Gluc.	Solids not Sugar	Purity	Gluc. Ratio	Tons Cane per Acre
D. No. 74, plant	15.1	12.20	1.02	1.88	80.80	8.86	....
D. No. 95, plant	14.7	12.70	.86	1.14	86.39	6.77	....
Home plant	14.1	10.00	2.78	1.32	70.92	27.80	....
D. No. 74, 1st yr. stubble	13.7	11.00	1.15	1.55	80.29	10.45	.....
Home, 1st yr. stubble	14.6	11.20	2.00	1.40	76.71	17.86	....

1896.

							Harvested
D. No. 74, plant	13.41	8.90	2.50	2.01	66.44	28.09	Oct. 12
D. No. 95, plant	15.54	12.20	1.61	1.73	78.51	13.20	Oct. 12
Home, plant	13.37	10.10	1.81	1.46	75.54	17.92	Oct. 24

1897.

D. No. 74, plant	17.80	15.10	.96	1.74	85.95	6.49	48.13
D. No. 74, plant	17.20	14.10	1.19	1.91	81.97	8.44	45.69
D. No. 95, plant	15.65	12.70	1.18	1.77	81.15	9.29	35.28
D. No. 95, plant	15.70	12.25	1.51	1.94	74.84	13.42	34.86
Home, plant	13.80	10.80	1.14	1.86	78.26	10.55	38.55
Home, plant	14.00	10.95	1.05	2.00	78.21	9.58	34.60

1898.

D. No. 95, plant	13.61	10.65	1.58	1.38	78.25	14.84	37.38
Home, plant	12.66	9.00	1.68	1.98	71.09	18.74	30.57
D. No. 74, 1st. yr. stubble	13.50	10.20	1.50	1.80	75.55	14.70	....
Home, plant	12.22	8.40	1.96	1.92	68.74	20.95	23.01

1899.

D. No. 74, plant	17.63	15.20	.67	1.76	86.21	4.41	....
D. No. 95, plant	17.80	13.30	2.38	2.12	74.71	17.89	....
Home, plant	16.12	13.25	1.39	1.48	82.19	10.49	....

1900.

D. No. 95, plant	14.40	11.05	1.58	1.77	78.55	12.28	33.13
Home, plant	13.58	10.10	1.64	1.84	74.37	16.23	30.93
D. No. 74, 1st. yr. stubble	15.80	12.95	.93	1.92	81.96	7.18	29.82
Home, 1st. yr. stubble	14.80	11.35	2.00	1.45	76.39	17.62	27.34

1901.

D. No. 74, plant	15.25	12.00	1.21	2.04	78.68	10.08	38.60
D. No. 95, plant	14.90	11.90	1.70	1.30	79.86	14.28	32.87
Home, plant	14.70	11.00	1.68	2.02	74.83	15.27	32.76
D. No. 74, 1st. yr. stubble	15.90	13.20	.81	1.89	83.01	6.13	43.68
D. No. 95, 1st. yr. stubble	15.15	12.00	1.44	1.77	79.20	12.00	38.20
Home, 1st. yr. stubble	14.34	11.00	1.96	1.38	76.70	17.81	31.15
D. No. 74, 2d yr. stubble	16.20	13.25	.93	2.02	81.79	7.01	32.00
D. No. 95, 2d yr. stubble	15.35	12.30	1.50	1.55	80.13	12.19	27.84
Home, 2d yr. stubble	13.90	10.15	1.96	1.79	73.02	19.31	31.92

1902.

D. No. 74, plant	15.87	12.60	1.25	2.02	79.39	9.92	36.02
D. No. 95, plant	14.72	11.40	1.51	1.61	77.44	13.24	26.12
Home, plant	13.66	10.50	1.78	1.38	76.87	16.95	32.90
D. No. 74, 1st yr. stubble	15.58	12.10	1.00	2.48	77.66	8.26	30.40
D. No. 95, 1st yr. stubble	15.80	12.30	1.27	1.86	79.71	10.32	29.40
Home, 1st yr. stubble	15.36	12.50	1.16	1.75	81.38	8.88	21.23
D. No. 74, 2nd yr. stubble	17.20	14.75	.52	1.93	85.75	3.52	30.91
D. No. 95, 2nd yr. stubble	16.14	13.80	.83	1.51	85.50	6.01	32.59
Home, 2nd yr. stubble	14.43	10.30	1.78	2.35	71.37	17.28	20.32

1903.

D. No. 74, plant	16.25	13.15	1.01	1.89	82.15	7.57	34.86
D. No. 95, plant	16.40	13.20	1.14	1.86	81.48	8.63	32.51
Home, plant	15.90	13.00	1.20	1.70	81.76	9.23	31.15
D. No. 74, 1st yr. stubble	16.95	14.40	.79	1.76	84.95	5.48	31.02

D. No. 95, 1st yr. stubble	17.20	15.10	.68	1.42	87.79	4.50	25.62
Home, 1st yr. stubble	16.20	13.20	1.37	1.63	81.48	10.37	27.25
D. No. 74, 2nd yr. stubble	16.20	13.10	.99	2.11	80.86	7.55	25.96
D. No. 95, 2nd yr. stubble	17.10	14.30	.74	2.06	83.62	5.17	17.18
Home, 2nd yr. stubble	15.92	12.64	1.31	1.97	79.39	10.36	18.17
D. No. 74, 3rd yr. stubble	16.50	13.65	.64	2.21	82.72	4.68	24.99
D. No. 95, 3rd yr. stubble	16.15	13.25	.90	2.00	82.04	6.79	29.82
Home, 3rd yr. stubble	15.40	12.50	1.23	1.67	81.16	9.84	25.31

An important fact to be noted is the low glucose content of D. 74 and D. 95 compared with home canes, particularly with the D. 74. The preceding tables give the relative results of the seedling canes D. 74 and D. 95 compared with our home canes in both tonnage of cane produced per acre and the sugar content of the cane juices. These are not in every instance strictly comparable, owing to the limited supply of these seedlings at first and their growing under different conditions, and this is particularly so after 1897 with the stubble seedlings owing to having harvested these early for distribution to planters and for our planting purposes at the station. For several years we were able to retain only a very small amount of these canes for analysis. The greater portion was harvested in October, while home canes compared with them were not harvested until a month or more later. It is well known that this early harvesting of cane very decidedly effects the tonnage of the subsequent stubble, and when continued for several years has a disastrous effect.

Before passing from the field and laboratory results, let us briefly note the characteristics of each year and the results.

In 1894 the cane crop was good, the rain fall nearly up to the average, spring and summer months favorable, and a dry fall. A good tonnage was obtained, and a fair sugar content. This year the first crop of seedlings D. 74 and D. 95 were obtained and both showed a very favorable growth, with promise of good tonnage. They were analyzed and D. 95 had 3 to 3.6 per cent. more sucrose than our home canes, while D. 74 had .60 per cent. more. Tonnage was not determined owing to limited quantity of the seedlings. On Dec. 29th, after the cane had been harvested, the temperature went down to 19 degrees, killing and splitting the cane. The results for 1895 will show how these seedlings stood this cold.

1895 was ushered in with one of the coldest spells known up to that time to this climate, accompanied with heavy snow lasting several days. 15 degrees F., was recorded on Feb. 14th. This year these seedlings (D. 74 and D. 95) showed their hardiness by withstanding the freeze of December, 1894, and February, 1895, equally as well if not better than our home canes. The growing season of this year was very wet in May and June, too much so for good cultivation, and too dry in July, August and September for large yields. A fair tonnage was produced, with a fair sugar content. D. 74 showed 2.2 per cent. and D. 95, 2.7 per cent. of sucrose over home plant canes and D. 74 first year stubble was practically the same as home canes in sucrose. No tonnage was determined owing to limited supply of cane and a desire to extend the area.

1896 was only a fair year for sugar cane; the spring was wet and a small rainfall in July, August and September. Fall was fairly wet. Tonnage was under the average, but sugar content good. There were no strictly comparative tests of D. 74 and D. 95. The analyses reported in the above table were made at the time of planting, Oct. 12, and are compared with home canes at harvest. Owing to the desire to increase our area of these seedlings all the cane was used for planting purposes and none reserved for the mill.

1897 was a fairly good year for both sugar content and tonnage; the rainfall was light, but fairly well distributed, somewhat small during the summer months, the season of growth.

This year was the first that complete comparative field results were possible. D. 74 was 3.72 per cent. richer in sucrose, and D. 95, 1.6 per cent. richer in sucrose than home canes, grown under identically the same condition on parallel rows. The average tonnage per acre of plant cane were as follows: D. 74, 46.91, D. 95, 35.07, and Home canes 36.57.

1898 was a memorable year to our sugar planters, noted for the exceedingly green cane. The rainfall while not up to the average was excessive in the fall months, and in September 19.55 inches of rain fell at the Sugar Experiment Station. No extreme cold was experienced. All cane was very immature this year owing to the heavy demand for seed cane by our planters; there were only small areas of D. 74 and D. 95 reserved for tests, which were as follows:

D. 74 was 1.8 per cent. of sucrose above home canes in first year stubble, and D. 95 in plant 1.65 per cent. of sucrose above home plant, and a yield of nearly 7 tons of cane per acre more than home canes.

1899—This year is remarkable for the cold of the greatest severity ever known in this latitude. In February a minmum of 6 degrees F. above zero was recorded, destroying nearly all of the stubble and seriously injuring the plant and seed cane. The tonnage was accordingly very short. Where good stands were obtained, both tonnage and sugar content were fair; the growing season being fairly favorable. D. 74 showed 1.95 per cent. of sucrose more than home canes, and D. 95 only .05 per cent. over home canes. Owing to the necessity of a large planting there was not enough cane left for tonnage determinations. The seedling canes stood this severe cold as well if not better than home canes in plant and the stubble was markedly better than home stubbles.

1900—The spring was extremely wet, the summer fairly favorable, and the fall dry. No killing frosts occurred, tropical plants and sugar cane living throughout the entire winter, yet the aggregate cold was nearly as great as a year of freezes. This year was rather favorable to the growth and development of sugar cane. D. 95 plant was .95 per cent. richer in sucrose than home canes, and gave 2.2 tons of cane per acre over our home canes. D. 74 in first year stubble yielded 2.48 tons of cane per acre more than home canes, and was 1.6 per cent richer in sucrose. This forcibly shows its hardiness compared with home canes, both having passed through the severe cold of 1899.

1901—The spring was very dry, the summer favorable and the fall dry. The year was rather favorable as a whole for the December, which was the coldest killing freeze within the records growth and development of cane crops, and but for the freeze in of the Sugar Experiment Station during the harvest season, the largest crop of sugar ever made would have been harvested. This freeze was prolonged, lasting over a week, with a minimum temperature of 21 deg. F., and caused great injury to all standing cane over the State. In yields of plant cane, D. 74 was 1.00 per cent. and D. 95, 90 per cent. above home canes in sucrose, and in tonnage D. 74 gave 5.82 tons per acre more than home canes, and D. 95, .21 tons over home. First year's stubble, sucrose, D. 74, 2.20 per cent., D. 95, 1.00 per cent. above home canes. Tonnage, D. 74, 12.53 and D. 95, 7.05 more than home canes.

Second years stubble D. 74 showed 3.1 per cent. more sucrose and D. 95, 2.15 per cent. more sucrose than home canes; while in tonnage D. 74 and home canes were practically the same, and D. 95 showed 4.08 tons per acre less than home canes.

The tonnage on second year's stubble are not really comparable owing to the seedling canes having been cut early for distribution and fall planting in previous years, while the home canes were not cut until harvest time. This applies particularly to D. No. 74 in second year's stubble, as it had been cut early in both plant and 1st year's stubble.

1902—The spring was fairly favorable, but cold, the summer very dry; the cane growing very slowly until September, and the fall favorable. A fair crop was harvested, with a fair sugar content. Plant cane D. 74 was 2.1 per cent. and D. 95, .9 per cent. richer in sucrose than home canes, and D. 74 gave 3.12 tons per acre more than home canes, while D. 95 shows 6.78 tons less than home canes. This was due to an imperfect stand of D. 95 and its being planted on the poorest plat on the Experiment Station. First year's stubble D. 74 was .4 per cent and D. 95, .2 per cent. below home canes in sucrose, while in tonnage per acre D. 74 gave 9.17 and D. 95, 8.17 tons more per acre than home canes. This slight decrease below home canes of D. 95 in sucrose being much more than equalled by the large increase in tonnage of the seedling canes. Second year's stubble, D. 74 was 4.45 per cent. and D. 95, 3.50 per cent. richer in sucrose than home canes, and in the tonnage per acre D. 74 gave 10.59 and D. 95, 12.27 tons per acre more than home canes.

1903—The early spring was cold and very wet, followed by cool dry weather in the late spring. The land was packed and tilth severely affected; spring planting was done under most trying conditions, the summer was dry and nfavorable for growth, and the fall very dry. Irrigation was practised three times at the Experiment Station. The tonnage produced in the State was very light, but the juice was uniformly high in sucrose. The killing frost in November did little damage other than checking the growth and further maturity of the cane.

Plant Cane—D. 74 was .35 per cent. and D. 95 was .20 per cent. richer in sucrose than home canes, and in tonnage D. 74 gave 3.71 and D. 95, 1.36 tons of cane per acre more than home canes.

First year's stubble—D. 74 was 1.20 per cent. and D. 95 was 1.90 per cent. richer in sucrose than home canes, and in tonnage D. 74 gave 3.77 tons per acre more than home canes, while D. 95 gave 1.63 tons less than home canes. This low yield is due to the great difference in land on which the home canes and D. 95 were grown; the former was on one of our best plats and the latter (D. 95) on our worst cane plat and a very black soil. D. 74 and our home canes were on the same character of soil and are comparable in every way.

Second year's stubble—D. 74 was .46 per cent. and D. 95 was 1.66 per cent richer in sucrose than home canes. In tonnage D. 74 gave 7.79 tons per acre more than home canes, while D. 95 gave .99 ton less. This decrease is unquestionably due to the earlier cutting of this cane in previous years for distribution, while the home canes were not cut last year until harvested.

Third year's stubble—D. 74 was 1.15 per cent and D. 95 was .75 per cent. richer than home canes. In tonnage D. 74 gave practically the same yield as home canes and D. 95 an increase of 4.51 tons of cane per acre. These yields again are not strictly comparative owing to the early harvesting of D. 74 and D. 95 for distribution during previous years. It must be noted that these yields are very good for third year's stubble. This is largely due to the cane being grown on our best plat, and to irrigation.

To summarize, the following table shows the average yields of these canes, i. e., D. 74 and D. 95 and Home canes, averaged for the years where a complete comparison was possible, excepting early harvesting, which affected the seedlings (D. 74 and D. 95) only, the home canes having been harvested only at the time of grinding and not taking into consideration the soil conditions, which as a rule would be adverse to the seedlings, embracing plant and first year's stubble for four years, second year's stubble for three years and third year's stubble for one year:

Variety	Brix	Suc.	Gluc.	Solids not Sugar	Purity	Gluc. Ratio	Tons Cane per Acre
D. 74, plant	16.22	13.14	1.13	1.95	81.01	8.60	39.02
D. 95, plant	15.42	12.24	1.55	1.63	79.37	12.66	31.69
Home, plant	14.54	11.34	1.69	1.51	77.99	14.90	33.34
D. 74, 1st yr. stubble	16.06	13.41	.88	1.77	83.49	6.56	33.73
D. 95, 1st yr. stubble	16.05	13.13	1.13	1.79	81.81	8.61	31.07
Home, 1st yr. stubble	15.18	12.01	1.63	1.55	79.12	13.49	26.74
D. 74, 2d yr. stubble	16.53	13.70	.81	2.02	82.88	6.91	29.62
D. 95, 2d yr. stubble	16.20	13.50	1.02	1.68	83.33	7.55	29.02
Home, 2d yr. stubble	14.75	11.03	1.68	2.04	74.78	15.23	23.47
D. 74, 3rd yr. stubble	16.50	13.65	.64	2.21	82.72	4.68	24.99
D. 95, 3rd yr. stubble	16.15	13.25	.90	2.00	82.04	6.79	29.82
Home, 3rd yr. stubble	15.40	12.50	1.23	1.67	81.16	9.84	25.31

Before passing the above table, a very striking point to be noted is the low glucose content of D. 74,and also, though not so marked, that of D. 95 in every instance, a great advantage in working this juice in the Sugar House. From this table it is noted that on plant cane D. 74 averages 1.80 per cent. of sucrose over home canes and an increase of 5.68 tons of cane per acre. D. 95 averages .90 per cent of sucrose over home canes and a decrease of 1.65 tons is noted in comparison with home canes. This is due to the low yield of one season owing to the plat on which D. 95 was cultivated, as explained before, was our poorest plat, and this was spring plant against home cane fall plant. Eliminating that year's result, the average tonnage is 33.54, slightly above home canes.

First year's stubble shows D. 74 was 1.40 per cent. and D. 95 was 1.12 per cent above home canes in sucrose, and D. 74 gave 6.99 tons and D. 95 gave 4.33 tons of cane per acre more than home canes.

Second year's stubble shows D. 74 was 2.67 per cent. and D. 95 was 2.47 per cent above home canes in sucrose, and D. 74 gave 6.15 tons and D. 95, 5.55 tons of cane per acre more than home canes.

Third year's stubble (only one year's results), and in which the D. 74 and D. 95 had been cut early for distribution and planting several times, thus materially affecting the stand, while home canes had only been cut at harvest seasons, D. 74 was 1.15 per cent. and D. 95 was .75 per cent. above home canes in sucrose and D. 74 gave .32 tons less, and D. 95 gave 4.51 tons of cane per acre more than home canes.

Reducing the above to a more practical basis and assuming cane to be worth $3.00 per ton, the following increased output in money per acre would be derived from one acre of cane with D. 74 and D. 95 canes, over our home canes:

D. 74 plant cane	$17.04 per acre
D. 95 plant cane*	.60 per acre
D. 74 1st year stubble	20.97 per acre

D. 95 1st year stubble	12.92 per acre
D. 74 2nd year stubble	18.45 ptr acre
D. 95 2nd year stubble	16.65 per acre
D. 74 3rd year stubble	.96 per acre
D. 95 3rd year stubble	13.53 per acre

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*Taking average plant as 33.54 tons per acre.

The lower tonnage of D.74 in third year stubble is due to its having been cut early for distribution more frequently than D. 95, and, as before stated, the home canes were not cut until the regular harvest season.

Applying another method of estimating the value of sugar cane, using the factor of eight (8) times the sucrose content of the cane, multiplied by the price of yellow clarified suga per pound on the New Orleans market. This basis is the average, or about the average of the summary of methods proposed by papers on this subject presented to the Louisiana Sugar Planters' Association in 1899 in a review of these methods by Dr. Wm. C. Stubbs.

The following are the results, assuming yellow clarified sugar to be worth four (4) cents per pound on the New Orleans market:

Variety	Tonnage of cane of acre	Per cent of sucrose in cane juice	Value of cane per ton	Value of cane per acre
D. 74, plant	39.02	13.14	$4.40	$153.08
D. 95, plant	33.54	12.24	3.92	131.48
Home, plant	33.34	11.34	3.63	121.02
D. 74, 1st yr. stubble	33.73	13.41	4.29	144.70
D. 95, 1st yr. stubble	31.07	13.13	4.20	130.49

Home, 1st yr. stubble	26.74	12.01	3.64	97.33
D. 74, 2nd yr. stubble	29.62	13.70	4.38	129.74
D. 95, 2nd yr. stubble	29.02	13.50	4.32	125.37
Home, 2nd yr. stubble	23.47	11.03	3.53	82.91
D 74, 3rd yr. stubble	24.99	13.65	4.37	109.11
D. 95, 3rd yr. stubble	29.82	13.25	4.24	126.44
Home, 3rd yr. stubble	25.31	12.50	3.95	99.97

The above results represents the values of an acre of cane in plant and first, second and third year stubble, calculated on a basis supposed and believed to represent an even distribution of the value of the product on a basis of four (4) cents per pound for yellow clarified sugar and giving one-half (1-2) to the producer of the cane and one-half (1-2) to the manufacturer of sugar, or the sugar factory.

From the above it will be noted that in plant cane

D. 74 gave an increase in value of...........	$32.06	over home
D. 95 gave an increase in value of...........	10.46	over home

In first year stubble

D. 74 gave an increase in value of...........	47.37	over home
D. 95 gave an increase in value of...........	33.16	over home

In second year's stubble

D. 74 gave an increase in value of...........	46.83 over home
D. 95 gave an increase in value of...........	42.46 over home

In third year's stubble

D. 74 gave an increase in value of...........	9.04 over home
D. 95 gave an increase in value of...........	26.47 over home

Taking a crop of plant and first year's stubble D. 74 gave an increase in value of $79.41 on one acre of each over one acre of each in the home canes, or an average of $39.70 per acre if the acreage of each were evenly divided. D. 95 giving an increase in value of $43.62 on one acre of each or an increase of $21.81 per acre if acreage were evenly divided. Plant, first and second year's stubble canes give for the three acres an increase of $88.45, or an average of $29.48 per acre over home canes for D. 74, and an increase of $86.08 for three acres, one acre of each over home canes, or an average of $28.69 per acre over home cane, for D. 95. Plant, first, second and third year's stubble, the increase of the four acres for D. 74 is $95.12, an average of $26.28 per acre over home canes, and for D. 95 is $112.55 for the four acres, an average of $28.14 per acre over home canes.

These are the results secured at the Sugar Experiment Station from an agricultural standpoint, or Field Results.

SUGAR HOUSE RESULTS.

Owing to the time required to increase our supply of D. 74 and D. 95, and after having secured a fair area in these canes, the desire to distribute these canes throughout the State, it was not possible for the station to make any sugar house tests until 1901.

In 1901, a strike or run in the sugar house was made with a mixture of plant and first year's stubble canes of D. 74 and D. 95 with the following results:

RUN NO. 8, 1901. D. 74 AND D. 95 PLANT AND FIRST YEAR'S STUBBLE.

Extraction on Nine (9) Roller Mill, Without Saturation, 75.36 Per Cent.

Analysis of cane juice:

	Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
D. 74	15.54	12.59	.93	2.02	81.02	7.38
D. 95	14.85	11.72	1.42	1.71	78.92	12.12
Average	15.20	12.16	1.17	1.87	80.00	9.62

Yield in sugars per ton of cane:

First sugar	143.6 lbs. of 94.5 per cent. sucrose
Second sugar	36.6 lbs. of 81.9 per cent. sucrose
Third sugar	5.4 lbs. of 84.4 per cent. sucrose
Total sugars	185.6 lbs. per ton of cane.

Available chemically pure sugar per ton of cane ground, 165.7 lbs. Total sugars obtained per ton of cane reduced to chemical pure sugar, 170.2 lbs.

AVERAGE OF RUNS ON HOME PLANT AND FIRST YEAR'S STUBBLE, 1901.

Extraction on Nine (9) Roller Mill, Without Saturation, 73.20 Per Cent.

Analysis of cane juice:

Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
14.32	10.65	1.85	1.82	74.34	17.42

Yield in sugars per ton of cane:

First sugar	116.8 lbs. of 91.3 per cent. sucrose
Second sugar	28.1 lbs. of 71.0 per cent. sucrose
Total Sugars	144.9 lbs. per ton of cane.

Available chemical pure sugar per ton of cane ground, 128.8 lbs. Total sugars obtained per ton of cane, reduced to chemical pure sugar 126.6 lbs.

SUGAR HOUSE RESULTS, 1902.

RUN NO. 6, HOME CANE, PLANT.

Extraction on Nine (9) Roller Mill, Without Saturation, 75.67 Per Cent.

Anaylsis of cane juice:

Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
14.53	10.68	1.68	2.17	73.50	15.75

Yield in sugars per ton of cane:

First sugar	113.4 lbs. of 96.05 per cent. sucrose
Second sugar	33.2 lbs. of 88.00 per cent. sucrose
Third sugar	10.1 lbs. of 80.00 per cent. sucrose
Total sugars	156.7 lbs. per ton of cane.

Available chemical pure sugar per ton of cane ground, 136.2 lbs. Total sugars obtained per ton of cane reduced to chemical pure sugar, 146.2 lbs.

RUN NO. 7, D. 74, PLANT CANE.

Extraction on Nine (9) Roller Mill, Without Saturation, 76.55 Per Cent.

Analysis of cane juice:

Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
15.66	12.66	1.20	1.80	80.84	9.48

Yield in sugars per ton of cane:

First sugar	138.4 lbs. of 94.05 per cent. sucrose
Second sugar	36.6 lbs. of 76.80 per cent. sucrose
Third sugar	12.8 lbs. of 80.00 per cent. sucrose
Total sugars	187.8 lbs. per ton of cane.

Available chemical pure sugar per ton of cane ground, 175.5 lbs. Total sugars obtained per ton of cane reduced to chemical pure sugar, 168.5 lbs.

SUGAR HOUSE RESULTS, 1903.

Run No. 4, First Year's Stubble, Home Cane.

Extraction on Nine (9) Roller Miller, Without Saturation, 71.52 Per Cent.

Analysis of cane juice:

Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
16.20	13.20	1.37	1.63	81.48	10.37

Yield of first sugar per ton of cane, 138.9 lbs. of 95.4 per cent. sucrose.

Available chemical pure sugar per ton of cane ground, 169.2 lbs.

First sugar obtained reduced to chemical pure sugar per ton of cane, 132.5 lbs.

Run No. 5, First Year's Stubble, D. 74.

Extraction on Nine (9) Roller Mill, Without Saturation, 73.35 Per Cent.

Analysis of cane juice:

Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
16.95	14.40	.79	1.76	84.95	5.48

Yield of first sugar per ton of cane, 162.7 lbs. of 95.5 per cent. sucrose.

Available chemical pure sugar per ton of cane ground, 199.7 lbs.

First sugar obtained per ton of cane, reduced to chemical pure sugar, 155.4 lbs.

Run No. 6, Plant, First, Second and Third Year's Stubble, D. 95.

Extraction on Nine (9) Roller Mill, Without Saturation.

Plant cane	76.00	per cent.
1st year's stubble	72.68	per cent.
2nd year's stubble	74.71	per cent.
3rd year's stubble	70.25	per cent.
Average extraction of all canes for the run	73 79	per cent.

Analysis of cane juice:

Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
16.30	13.21	1.10	1.99	81.04	8.33

Yield of first sugar per ton of cane, 145.6 lbs. of 95.8 per cent. sucrose.

Available chemical pure sugar per ton of cane ground, 188.7 lbs.

First sugar obtained per ton of cane reduced to chemical pure sugar, 139.5 lbs.

Run No. 7, Home Canes, Plant.

Extraction on Nine (9) Roller Mill, Without Saturation, 74.75 Per Cent.

Analysis of cane juice:

Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
15.90	13.00	1.20	1.70	81.76	9.23

Yield of first sugar per ton of cane, 141.4 lbs. of 95.75 per cent. sucrose.

Available chemical pure sugar per ton of cane ground, 177.4 lbs.

First sugar obtained per ton of cane reduced to chemical pure sugar, 135.4 lbs.

RUN NO. 8. PLANT, SECOND AND THIRD YEAR'S STUBBLE, D. 74.

Extraction on Nine (9) Roller Mill, Without Saturation.

Plant	80.86	per cent.
2nd year's stubble	73.70	per cent.
3rd year's stubble	73.89	per cent.
Average extraction of all canes for the run....	77.39	per cent.

Analysis of juices:

Brix	Suc.	Gluc.	Solids not Sugar	Purity	Glucose ratio
16.16	13.31	.89	1.96	82.36	6.69

Yield of first sugar per ton of cane, 146.8 lbs. of 95 per cent. sucrose.

Available chemical pure sugar per ton of cane ground, 192.2 lbs.

First sugar obtained per ton of cane reduced to chemical pure sugar, 139.5 lbs.

In conjunction with these runs in the sugar house experiments on the extraction of home canes, compared with D. No. 74 on a nine roller mill without saturation or dry. The juice expressed by each mill was taken and analyzed separately and the extraction determined for each mill separately. The following are the results:

HOME CANE, TOTAL EXTRACTION, 72.13 PER CENT.

	First Mill	Second Mill	Third Mill
Extraction	64.50	5.50	2.13
Brix....	15.36	14.60	15.12
Sucrose	12.93	11.41	11.82
Glucose	1.54	1.29	1.23
Ash	.37	.58	.72
Albuminoids and Amids	.18	.50	.58
Free Acid	.10	.11	.14
Combined Acid	.14	.15	.12
Gums	.10	.56	.51
Coefficient of Purity	84.07	78.15	78.17
Glucose Ratio	11.91	11.30	10.40

D. No. 74 CANE, TOTAL EXTRACTION, 80.00 PER CENT.

	First Mill	Second Mill	Third Mill
Extraction	70.75	7.00	2.25
Brix	17.02	16.65	16.64
Sucrose	14.93	13.80	13.57
Glucose	1.11	.81	.83
Ash	.45	.67	.74
Albuminoids and Amids ...	.12	.36	.46
Free Acid	.10	.13	.14
Combined Acid	.17	.21	.21
Gums	.14	.67	.69
Coefficient of Purity	87.72	82.88	81.55
Glucose	7.44	5.88	6.11

In comparing these results the following is to be noted. The total extraction obtained shows a very large increase with the D. 74 over home cane, the per cent. of increase being 7.87, or nearly

11 per cent. more juice from D. 74 than that obtained from home cane. The D. 74 gave an increased per cent. extraction on each of the three mills.

In comparing the analyses, the impurities extracted are of most interest, the sugar content of the canes having been compared in detail before.

In ash D. 74 is higher than home canes on all the mills, though in the juice extracted from the third mill the difference is very slight. Albuminoids and Amids, D. 74 is lower than home canes in the juice from all the mills; with the free acid there is very little difference. Combined acids in D. 74 is slightly greater than home canes, and show an increase in the second and third mill juices over the first mill, while in the juice from the home canes the first and second mill have practically the same amount and a slight decrease is noted in the third mill.

Gums in the juice from both home cane and D. 74 increase markedly in the second and third mills over the first mill, the per cent. in the second and third mills being nearly the same, and D. 74 has a larger percentage of gums from all mills.

In all of the above runs the extraction is given on the cane dry or without saturation. The above are the results in the sugar house of D. 74, D. 95 and home canes, and on close perusal show decided results favorable to D. 74 and D. 95.

Summarizing these results it is noted that in 1901, D. 74 and D. 95 mixed gave a total yield of 185.6 lbs. of total sugars, first, second and third, per ton of cane ground, with an extraction of 75.36 per cent., and home canes of the same age gave 144.9 lbs. of total sugars, first and second, no thirds being made, since all available sugar was extracted in first and seconds, with an extraction of 73.02 per cent.; showing an increase of 2.34 per cent. in extraction for the D. 74 and D. 95 over home canes, and an increase of 40.7 lbs. of sugar per ton of cane ground.

1902—D. 74 plant and Home cane plant were run in the sugar house as comparative runs, the results were as follows:

Extraction, D. 74, 76.55 per cent. Home Cane, 75.67 per cent., an increase of .88 per cent. for D. 74.

Total sugars obtained per ton were: for D. 74, 187.8 lbs. Home canes, 156.7 lbs., an increase of 31.1 lbs. for D. 74.

1903—There were three runs of seedling canes made this year, only one of which, that of the first year's stubble D. 74, is strictly comparable with home canes. The other two runs are compared with Home plant, and fairly well so, since D. 74 and D. 95 plant formed the greater proportion of the cane entering runs 6 and 8 respectively, and the sugar contents of these plant canes are practically the same as the average of the cane juice for these runs.

D. 74 first year's stubble gave the following results:

Extraction, 73.35 per cent. Home canes, first year's stubble, 71.52 per cent., an increase of 1.83 per cent. for D. 74.

First sugar obtained per ton of cane from D. 74 is 162.7 lbs., and from Home canes 138.9 lbs., an increase of 23.8 lbs. per ton of cane for D. 74.

In runs 6, 7 and 8, the results are not strictly comparable other than extraction, and only this will be noted:

D. 74 plant gave an extraction of 80.86 per cent., and Home plant 74.75 per cent., an increase of 6.11 per cent. in extraction for D. 74 over home canes.

D. 95 plant, gave an extraction of 76.00 per cent., an increase of 1.25 per cent. over home canes, and a decrease of 4.86 per cent. compared with D. 74.

It is particularly striking that the extraction with D. 74 shows a much greater per cent. of juice obtained than from home canes under the same conditions. Bringing this data to a practical basis and restricting comparisons to plant and first year's stubble canes where comparative tests have been made, the following table gives the yield of D. 74 and Home canes:

Variety of Cane	Pounds of Sugar obtained per ton of Cane
Home cane, plant	156.7
D. 74, plant	187.8
Home cane, first year's stubble	138.9*
D. 74, first year's stubble	162.7*
Average of Home cane, plant and first year's stubble	147.80
Average of D. 74, plant and first year's stubble	175.25

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*First sugar only.

showing an increase of 27.45 lbs. of sugar per ton as an average of plant and first year's stubble D. 95 over the same average of home canes. With D. 95 the sugar house results are not comparative enough to justify this data and are not included.

Assuming the total sugars to be worth an average of 3.50 cents per pound on New Orleans market, and applying this, we have the following value in sugar output per ton of cane:

Variety of Cane	Pounds of Sugar obtained per ton	Price of Sugar in cents per pound	Value of Sugar from one ton of cane
Home cane, plant	156.7	3.50	$5.48
D. 74, plant	187.8	3.50	6.57
Home cane, 1st year stubble	138.9*	3.50	4.86
D. 74, 1st year stubble	162.7*	3.50	5.69
Average of Home cane, plant and first year's stubble	147.80	3.50	5.17
Average of D. 74, plant and first year's stubble	175.25	3.50	6.13

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*First sugar only.

Here it is noted that the value of the sugar produced from one ton of plant D. 74 is $1.09 more than from home canes, and with first year's stubble $0.83 more, or an average of $0.96 per ton plant and first year's stubble. Applying this data to the operations of a sugar house grinding 500 tons of cane per day we have the following:

Variety of Cane Ground	Value of Sugar per ton of cane ground	Tons ground per day	Value of Sugar produced per day
Home cane, plant	$5.48	500	$2740.00
D. 74, plant	6.57	500	3285.00
Home cane, 1st year's stubble	4.86*	500	2430.00
D. 74, 1st year's stubble	5.69*	500	2845.00
Average of Home cane, plant and first year's stubble	5.17	500	2585.00
Average of D. 74, plant and first year's stubble	6.13	500	3065.00

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*First sugar only.

Here it is noted that the increase in value of the output per day is considerable and D. 74 is far in excess of home canes. On plant cane the increase is $545.00 per day, on first year's stubble $415.00 per day, an average of $480.00 per day for both plant and first year's stubble D. 74 over Home canes.

The yield of sugar in first year's stubble compared with plant canes includes only first sugar, while the plant yields are total sugars obtained. The second and third sugars, from first year's stubbles are now in process of manufacture.

Such are the results secured at the Louisiana Sugar Experiment Station from the experiments on these canes. Applying these results to a sugar plantation cultivating 500 acres of cane, 250 acres in plant and 250 acres in first year's stubble, and grinding the same at its sugar house, we have the following results:

Variety of Cane	Tons of Cane produced on 250 acres	Pounds of Sugar produced on 250 acres	Value of Sugar at 3½c. per pound
Home plant	8335	1,306,094.5	$45,713.31
D. 74, plant	9755	1,831,989.0	64,119.61
Increase of D. 74 over Home	1420	525,894.5	$18,406.30
Home, 1st year's stubble	6685	928,546.5*	$32,499.13
D. 74, 1st year's stubble	8432	1,371,886.4*	48,016.02
Increase of D. 74 over Home	1774	443,339.9	$15,516.89

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*These yields are for first sugar only; seconds and thirds are not included, being in the process of manufacture.

This table represents the relative gain to the sugar planter and manufacturer from plant cane and from the first sugars from stubble cane as shown by the results of the preceding experiments of D. 74 over home canes. Unfortunately, the run on first year's stubble D. 74 has not been completed, and was not made the same year as the run on plant D. 74, but they are compared with home cane of the same year, and same conditions under which they were produced. These results show an increased sugar yield of 40.3 per cent. on Plant D. 74 over Plant Home canes, and in first year's stubble an increase of 47.7 per cent in first sugar.

To recapitulate, to the sugar cane grower the following is predicated upon the basis of these results, on a field of 250 acres of plant and 250 acres of first year's stubble cane of these varieties separately, assuming cane to be worth $3.00 per ton,

D. 74 plant will yield $29,265.00 on 250 acres.
D. 95 plant will yield $25,155.00 on 250 acres.
Home plant will yield $25,005.00 on 250 acres.

D. 74, 1st year's stubble, will yield $25,296.00 on 250 acres.
D. 95, 1st year's stubble, will yield $23,902.50 on 250 acres.
Home, 1st year's stubble, will yield $20,055.00 on 250 acres.

Assuming yellow clarified sugar to be worth 4 cents per pound on the New Orleans market, and using the factor eight (8),

D. 74 plant will yield	$40,971.00	on 250 acres.
D. 95 plant will yield	$32,869.20	on 250 acres.
Home plant will yield	$30,339.40	on 250 acres.

D. 74, 1st year's stubble,	$36,173.28	on 250 acres.
D. 95, 1st year's stubble,	$33,263.50	on 250 acres.
Home, 1st year's stubble,	$22,729.00	on 250 acres.

These figures speak for themselves and show the marked superiority of D. 74 over both home canes and D. 95, and D. 95 is quite above home canes. This is the average from a field or sugar cane grower's standpoint, assuming the before mentioned values of cane per ton.

The results in a central factory grinding cane from 500 acres, 250 of plant and 250 first year's stubble, and paying $3.00 per ton for cane, will be as follows:

Variety of Cane	Value of Sugar obtained over price paid for cane
D. 74, plant	$34,854.61
Home, plant	20,708.31
D. 74, 1st year's stubble	22,720.02*
Home, 1st year's stubble	12,444.13*

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*These values refer to first sugars only, paying full price for cane.

With cane purchased by the factor 8 and the sugar content of the juice with yellow clarified sugar selling for 4 cents in New Orleans,

D. 74, plant	$23,148.61
Home, plant	15,373.91
D. 74, 1st year's stubble	11,842.74*
Home, 1st year's stubble	10,770.13*

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*These values refer to first sugars only, paying full price for cane.

These are the results of the experiments at the Sugar Experiment Station on these canes, and the application of the assumed values given to these results on a plantation of 500 acres of cane.

The following questions were submitted to our sugar planters relative to the practical results secured in 1903 from D. 74 and D. 95 canes:

1. Relative time of germination of D. 74 and D. 95 compared with home canes?

2. Rate of growth of D. 74 and D. 95, and home canes?

3. Capacity of withstanding drouth, excessive rains and winds storms, of D. 74 and D. 95 and home canes.

4. Relative time of laying by of D. 74 and D. 95 and home canes.

5. Tonnage per acre in plant, D. 74, D. 95, Home canes,
Tonnage per acre 1st year stubble, D. 74, D. 95, Home canes,
Tonnage per acre 2nd year stubble, D. 74, D. 95, Home canes.

6. Sugar contents of seedlings compared with home canes, and comparative analysis of the canes, if determined.

7. Sugar house results, viz.—Extraction, Clarification, Boiling, Purging, and yield in sugars of D. 74 and D. 95 and home canes, giving characteristics and comments. Please make these as near comparative tests as possible, giving results of canes of the same age, and those harvested at as near the same time as possible.

To these questions a large number of replies were received, and in many instances the canes had not been on the plantation a sufficient length of time and the quantity of cane was too small to justify any data. The following is a digest of the replies received to these questions:

(1) Mrs. C. Bubenzer, Bunkie, La.:

"D. 74 germinates two weeks earlier, and D. 95 one week earlier than home cane. D. 74 grows 25 per cent. faster than home canes till after lay by, when home canes catch up about Sept. 1st. D. 74 larger in diameter than home canes. D. 95 did not do well. Laid by D. 74 ten days earlier than home canes. D. 95 same time as home canes. Tonnage per acre in plant: D. 74, 20; D. 95, 15; Home canes, 18."

(2) Mr. S. N. Burnett, Burnside, La.:

"In germination D. 95 ahead of D. 74 and home canes. Rate of growth D. 95 above both D. 74 and home canes, the latter about equal. D. 95 resists drouth and wet weather best; D. 74 stands wind storms best. D. 95 laid by earlier, and D. 74 later than home canes. D. 95 gives the best tonnage."

(3) Messrs. Cambon Bros., Houma, La.:

"D. 74 germinates 25 per cent. earlier than home canes, grows more rapidly and suckers sooner and heavier than either of the other canes. Stands drouth and wind storms 100 per cent. better than home cane. Laid by two to three weeks earlier.

"Tonnage, plant, D. 74, 38; Home canes, 26.

"Tonnage, 1st year's stubble, D. 74, 32; Home canes, 22.

"D. 74 stubbles 50 per cent. better than home canes. The above tonnage from plant is from planting one stalk of D. 74 against two stalks lapped of home canes."

(4) Mr. Anatile Delaune, Albemarle, La.:

"Germination the same for all canes. D. 74 grows the same as home canes. D. 95 a little behind. Canes stand drouth about the same and are laid by the same time. Did not determine tonnage; planted all of both canes and prefer D. 74. Both do better than home canes, and sucker considerably more."

(5) Mr. J. B. Dubourg, Welcome, La.:

"D. 74 and D. 95 grow faster than home canes and resist drouth better; they are laid by earlier; no tonnage determined; kept all for seed."

(6) Mr. W. Edwards, Marksville, La.:

"D. 74 and D. 95 germinate one to two weeks earlier than home canes, and grow slower. Thinks canes all right, and expects to keep planting and increasing."

(7) Mr. D. B. Ells, Gibson, La.:

"Home cane germinates two weeks ahead of D. 74 and D. 95. Home canes blown down, others standing. Laid by at same time, and all canes the same height. Reserved all D. 74 and D. 95 for seed. First year's stubble D. 74 taller than purple cane, same height as ribbon, but ribbon cane larger. D. 95 larger stalk than D. 74 and more stalks, but only two-thirds the height."

(8) Mr. Walter Godchaux, Napoleonville, La.:

"D. 74 and D. 95 withstand drouth much longer than home canes, remaining entirely green, while home canes were somewhat dried up. This observation was made on plant cane in the same cut and soil, and with the same cultivation. Laid by at the same time. Tonnage not given; all kept for planting.

ANALYSIS OF CANES.

Variety	Date	Brix	Suc.	Gluc	Non-Sugar	Gluc. ratio	Purity
D. 74, 1st yr. Stubble	11-7-03	16.15	12.39	2.15	1.51	12.19	76.72
D. 74, Plant	"	15.30	11.50	2.12	1.68	14.16	75.81
D. 95, 1st yr. Stubble	"	16.65	13.77	1.60	1.28	9.29	82.70
D. 95, Plant	"	15.45	12.50	1.84	1.56	12.94	77.34
Home, 1st yr. Stubble	"	16.51	13.20	1.62	1.69	12.83	78.75
Home, Plant	11-27-03	15.76	13.02	1.45	1.18	9.85	82.50

These analyses hardly do justice to D. 74 and D. 95 on account of only one sample being taken, while with home canes several samples were taken.

(9) Mr. James P. Kock, Belle Alliance, La.:

"D. 74 and D. 95 somewhat slower in germination than home canes. D. 74 grows faster and D. 95 slower than home canes. D. 74 withstands drouth better than home canes and D. 95 suckers more than either D. 74 or home canes. D. 74 on Oct. 15th averaged 15 inches higher than all other varieties. Laid by at the same time and D. 74 was the tallest. Used all the D. 74 and D. 95 to plant, and no tonnage determined. D. 74 planted 13 for 1, using two stalks with lap. D. 95 planted 10 for 1, using two stalks with lap. Homes canes under same conditions as to stand and cultivation, and planted under same circumstances, planted 8 for 1. Personal observations during two seasons with D. 74

and D. 95 show the former is best suited for this climate. D. 95 having leaves with stickers and not attaining great size, is not a desirable variety. D. 74 not falling down and not being readily blown down, can be planted closer and will mature better than home canes. Its erectness would alone give it marked superiority over any other known varieties in this State."

(10) Messrs. B. & E. B. LaPice, Lauderdale, La.:

"From a few bundles of D. 74 and D. 95 received, we have now 25 acres. We think so well of these seedlings that we have continued planting them and will not be able to give any positive data before the end of this year."

(11) Mr. B. C. LeBlanc, Plaquemine, La.:

"Our small planting of D. 74 in 1903, stood the drouth very well, never losing its peculiar green color, and appeared very vigorous on a fine sandy loam soil. The stubble was partly in mixed soil, stand was very good, but a good many stalks were spindling and did not develop fully."

(12) Mr. J. Libermuth, Lauderdale, La.:

"Germination of varieties the same as home canes. Rate of growth 20 per cent. short of home canes. Last year's experience did not show any difference in withstanding drouth, excessive rains or storms. Laid by at the same time.

"Tonnage, D. 74 plant, 21.5; D. 95 plant, 20.75; Home, 22.5.

"Sucrose, D. 74 plant, 15.20 per cent.; D. 95 plant, 14.40 per cent.; Home, 12.5 per cent.

"From small amount of cane ground estimates D. 74 and D. 95 will give 30 lbs. more sugar per ton than home canes."

(13) Mr. R. A. Mayer, Delcambre, La.:

"Both varieties produce well and better than home canes, and appear richer in sugar. D. 95 is well liked by the farmers, but D. 74 not liked. The objection to D. 74 is its long flag and closely adherent leaves, making it more difficult to clean than home canes. With D. 95 also the flag breaks off when grasped by cutters for stripping. D. 95 stubbles well, but is later in coming up than home canes. Does not think D. 74 will prove popular."

(14) Hon. Henry McCall, McCall, La.:

"D. 74 is somewhat slower in germinating than home canes, perhaps a week or two; grows faster and may be one month ahead. Did not stand last year's drouth as well as home canes, but stands rains and storms without blowing down. D. 74 can be laid by two weeks earlier than home canes.

"Tonnage, per acre, in plant, D. 74, 22; Home, 16 to 18.

"D. 74 stubbles well.

"Sucrose, D. 74, 15 per cent.; Home canes, 12 to 13 per cent.

"Figured the yield of sugars for D. 74 at 198 lbs. per ton and home canes 170 pounds.

(15) Mr. J. M. McBride, Ellendale, La.:

"Ground 850 tons of D. 74 the past season, and obtained 141 pounds of choice yellow clarified sugar, and 8 3-4 gallons of molasses per ton. Sold the molasses for choice centrifugal, and planted 50 acres. This from one bundle of about 25 stalks received in 1900. Well pleased with it and intends to plant his place down in it another year, or as near as he can.

(16) Mr. John D. Minor, Houma, La.:

"Can give no accurate data as to germination, as all D. 74 has been planted in fall. D. 74 stubble seems to germinate earlier, but suckers more slowly than home canes. D. 74 seems larger and more vigorous from the start than home canes, and steadily outgrow them. This may be more apparent than real, on account of the upstanding top of D. 74, as I do not think D. 74 is any longer at maturity than home canes. D. 74 seems to stand drouth better and a heavy blow infinitely better than other varieties.

"Laid by the same time as other canes, but seemed taller. All D. 74 planted and no tonnage determined. D. 74 seems to stubble remarkably well, but was planted under favorable conditions and heavily manured."

(17) Mr. A. L. Monnot, Jeanerette, La.:

"D. 74 and D. 95 germinate some ten or fifteen days later than home canes, grow much faster, from ten to fifteen per cent. better. With good stands D. 74 and D. 95 stood drouth and cold better than home canes, growing very rank, and stood rain much better. Prior to last year D. 74 and D. 95 stood drouth and excessive rains far better than home canes, and wind strong enough to blow down home canes flat had no effect on D. 74 and D. 95.

"Laid by ten to fifteen days earlier. No tonnage determined. Has stubble in garden four years old, with perfect stand and better than any one year stubble on the plantation.

"Analyses from plant cane—D. 74, 16.2 per cent. sucrose, and purity 83.5 per cent.; D. 95, sucrose 14.5 per cent., and purity 82.8 per cent."

(18) John T. Moore Planting Co., Ltd., Schriever, La.:

"During the four years that we have been propagating these seedlings we have been struck with their suckering proclivities, their ability to resist wind storms and the brittleness of same, especially D. 74, which would seem to us to indicate a good milling cane. We are paying closer attention to D. 74 than D. 95 and expect to have our places seeded to this variety within the next year, should no developments arise to cause us to hesitate. We have put the plant cane of D. 74 down in windrow for spring planting and have found that it keeps well. The same remarks apply to first and second year's stubble. With D. 74 only equalling our home canes in tonnage, sucrose, hardiness, etc., we would propagate it solely on the ability of this cane (due to the location of the center of gravity) to stand erect in the face of wind storms that prostrate home canes. Have not milled any D. 74. D. 74 seems to have more top than home canes, but we do not believe it has."

(19) Mr. H. Gibbes Morgan, Jr., St. Rose, La.:

"Conditions last season did not justify an attempt at careful observation. All canes freakish in development. Old second year's stubble home canes vieing successfully with D. 74 plant. D. 74 slightly advanced in rate of growth. No appreciable difference in stands of plant in sandy lands, in the capacity of withstanding drouth, and excessive rains and storms. No tonnage determined; total area reserved for seed. 500 pounds of D. 74, fall plant, cut for analysis and ground on 6-roller mill.

"Analysis—Brix, 15.96; sucrose, 13.30; glucose, 1.51; Purity, 83.33."

(20) Messrs. Oxnard & Sprague, Adeline, La.:

"No difference observed in time of germination or in rate of growth of D. 74 and home canes. Have not enough D. 95 to have any fixed opinion. D. 74 stands drouth better and seems practically storm-proof. We have never had any blown down. Does not shade the ground as early as home canes and cannot be laid by as early.

"We have only weighed the D. 74 from five acres, which we ground; all other was planted and not weighed.

"D. 74 plant, averaged 24 1-2 tons to the acre, and similar home canes under 16 tons.

"Up to last fall we had never tested D. 74 after Nov. 1st, and we found it to contain less sugar than home canes. This last season we found it ripened in November and caught up with home canes. When ground about the middle of November it was practically the same as home cane. Our experience would seem to show that it was a late ripener."

(21) Mr. E. A. Pharr, Windom, La.:

"I am not in a position to answer any of the questions intelligently, having kept no record or memorandum, and had no tests made. I beg to state, however, that in 1903 I planted all the cane in very rich soil; it grew to be very tall and cut large in body, and to all appearances withstood the drouth better than home canes. I am highly pleased with what I have seen of it, and planted all I had last fall. I regret very much I am unable to answer the questions asked."

(22) Mr. John N. Pharr, Berwick, La.:

"D. 74 and D. 95 were late in germinating and late in putting out suckers. Were highly fertilized and grew faster than home canes after putting out suckers. Seem to withstand drouth and wind better than home cane. Laid by same time as home canes. Kept all D. 74 and D. 95 for seed. D. 95 appears to stool better than D. 74. From our limited analysis for sucrose and purity, D. 74 has a slight advantage over D. 95. Both D. 74 and D. 95 were put down for seed and have been found in perfect condition, while home canes have not kept so well."

(23) Mr. H. C. Rose, Franklin, La.:

"D. 74 germinates about the same time as home canes; appears to grow fastest all the time and looked the most thrifty through the drouth, but none stood that after the middle of August. On July 1st all my plant was the finest and largest cane I ever had in 45 years, but it stopped then and there and it was poorest I ever made when grinding came. Careful experiment under the same conditions, show without doubt D. 74 withstood drouth and all adverse conditions (they all came to me last season) better than any other kind of cane on my place. The home cane compared with D. 74 was planted the same day, laid by the same day, and harvested within forty-eight hours of each other.

"Tonnage—D, 74 plant, 16.5 per acre; Home cane, 13.5. Planted all stubble from D. 74 without weighing, but it planted more land than other canes. No chemical analysis made.

"D. 74 worked equally as well as any other cane in all processes of manufacture and in grinding we seemed to get a little more juice from the same feed. I consider D. 74 the best cane I ever ground in my mill. Secured 456 pounds of first sugar per acre more than home canes planted and grown under the same conditions and harvested in the same forty-eight hours."

(24) Mr. L. M. Soniat, Dorceyville, La.:

"D. 74 and D. 95 came out sooner and grew faster than home canes. Both stood drouth and storms very well, growing during the drouth and not blowing down with wind. Laid by at the usual time.

"Tonnage per acre in plant—D. 74, 28 tons; D. 95, 25 tons; Home, 25 tons.

"Did not grind any stubble and D. 74 and D. 95 were planted one cane lapped.

Ground on small mill—D. 74, 12.43 per cent. sucrose; D. 95, 13 per cent. sucrose, and Home canes, 11.39 per cent. sucrose.

Time of Harvest	Variety	Brix	Suc.	Purity	Gluc.
Oct. 14	D. 95, plant	15.6	12.3	78.88	——
From Mulberry	D. 95, 1st yr. stubble	16.2	13.8	85.20	——
Grove Plant'n	D. 95, 2nd "	16.3	13.4	82.20	——
From Cedar					
Grove Plant'n	D. 95, 2nd "	14.8	11.4	77.00	——
Oct. 25	D. 74, plant	14.8	10.8	73.00	1.61
Cedar Grove	Home, "	14.3	10.4	72.7	1.88
Plant'n, all	D. 95, "	14.6	10.7	73.3	1.78
adjoining	Home, "	13.9	10.0	71.9	1.96
Oct. 29					
Cedar Grove	D. 74, plant	17.7	15.0	84.7	1.00
Plantation	Home "	15.4	12.1	78.8	1.56

(25) Mr. J. G. Verret, New Iberia, La.:

"D. 74 and D. 95 rather late in germination compared with home canes, are of vigorous growth and appear hardy under all conditions. They may be worked later than home canes."

(26) Col. J. S. Webster, Cofield, La.:

"Planted in pea vine land April 1st. D. 95 came first and grew off best. Native canes next, but generally no better than D. 74 and dried up quicker. As to the rate of growth D. 74 about equal, though held on to life through dry cold April and May better than native canes. Kept on coming up till June and often found from one to ten suckers just under the ground or coming up with the shoots where late. D. 74 and D. 95 equal as to drouth; had no storms to test it. Laid by the same time. No tonnage, all put away for seed. Sold a few acres as it stood in the field at $5.00 per ton, last fall. It averaged 25 tons per acre.

"A rough test showed both equal or superior to native canes. My neighbors, Messrs. Ory, who have ground D. 74, say it makes more sugar and molasses than native canes, and that the difference would be a good profit on a crop of cane. That it will not blow down by storms, etc. I think well enough of D. 74 to have 86 acres in stubble, 75 acres in fall plant, and am planting all my spring plant, about 300 acres in it, on Terre Haute, and sent 40 tons to Point Houmas to start the seed there. If springs were all as dry as last, think it better to plant in the fall, though dry as it was D. 74 did not die, but lived like grape vines and kept on coming. I find it has wonderful vitality and think as second year's stubble it will be as good as first from home cane, and predict third year's stubble will be equal to second of ordinary cane."

(27) Dr. C. P. Wilkinson, Jesuit Bend, La.:

"From an agricultural standpoint I find each of these canes very satisfactory, they both rattoon very well and grow vigorously. D. 74 is the best cane for fall planting I have ever known. The erect habit of growth of these canes, especially the D. 74, insures ripeness at harvest. Greater cheapness in handling at harvest, the possibility of instituting harvesting machinery and closer planting."

These are the replies from our sugar planters, and as a whole confirm our results at the Experiment Station. In conclusion, the following results are to be noted: D. 74 is more vigorous, a more rapid grower, gives a larger tonnage, is an erect cane and believed from this to be more economical in harvesting, stubbles well if not better than home canes, gives a larger extraction, and has a larger sugar content, yielding more sugar per ton and giving a greater tonnage per acre than home canes. The same remarks in a lesser degree apply to D. 95.

SECOND SERIES, NO. [redacted]. 79

BULLETIN

OF THE

Agricultural Experiment Station

OF THE

LOUISIANA STATE UNIVERSITY AND A. & M. COLLEGE.

WM. C. STUBBS, PH. D., Director and State Chemist.

Results of Experiments with Nodule-Disease of the Intestines of Sheep

BY

W. H. DALRYMPLE, M. R. C. V. S.

ISSUED BY THE STATE BOARD OF AGRICULTURE AND IMMIGRATION,
J. G. LEE, COMMISSIONER.

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*Vacant.

The Bulletins and Reports will be sent free of charge to all farmers, by applying to Commissioner of Agriculture, Baton Rouge, La., or to the Director of the Station, Audubon Park, New Orleans, La.

VETERINARY DEPARTMENT, STATE EXPERIMENT
STATION

BATON ROUGE, LA., APRIL, 1904.

Dr. W. C. Stubbs, Director.

Dear Sir:—I beg to submit, herewith, the MSS. of a bulletin covering the results of experiments with Nodule Disease of the Intestines of Sheep, which have extended over several years. As the results of the early part of this work were published in Bulletin No. 74, I have taken the liberty of reproducing them in this, besides the greater part of the article on the disease, so that the continuity might be preserved, and the subject matter presented in its entirety in this bulletin.

Very Respectfully,
W. H. DALRYMPLE, Veterinarian.

LOUISIANA STATE UNIVERSITY AND A. & M. COLLEGE

BATON ROUGE, LA., APRIL, 1904.

Major J. G. Lee, Com. of Agriculture and Immigration,

Dear Sir:—I enclose you the results obtained by Dr. W. H. Dalrymple from some experiments, extending over several years, investigating the Nodular Disease of Sheep. These results suggest distinctly a method by which both sheep and pastures may be relieved of this great obstacle to successful sheep raising in the South.

I ask that this be published as Bulletin No. 78.

Respectfully submitted,
WM. C. STUBBS, Director.

RESULTS OF SOME EXPERIMENTS WITH NODULE-DISEASE OF THE INTESTINES OF SHEEP.

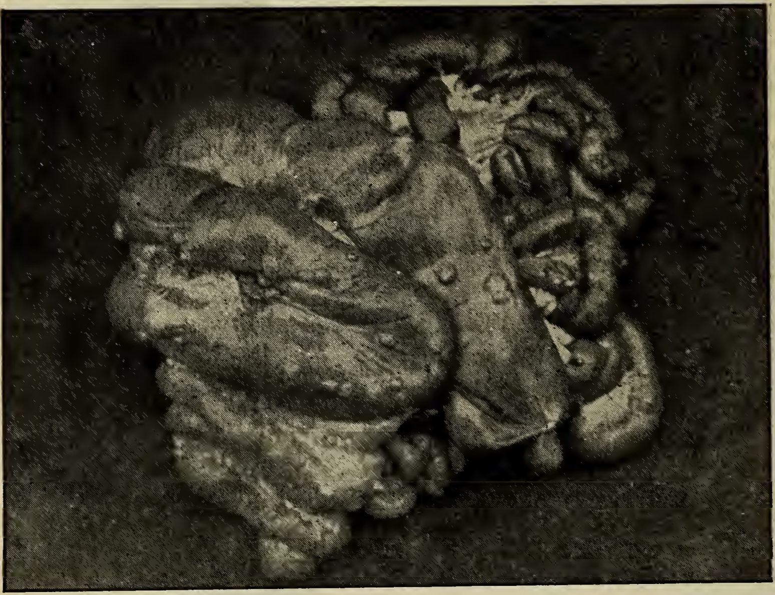
W. H. Dalrymple.

In order to give our readers an intelligent conception of the disease with which we have been experimenting, viz., "Nodule-Disease of the Intestines of Sheep," and the object of such experiments; also to preserve the continuity of the work, which has covered several years, we have taken the liberty of reproducing, in part, at least, the article on the subject, and, likewise, the whole of the first part of the work, which appeared in Station Bulletin No. 74, so that the entire subject matter might be given in connected form in this report. It is unnecessary, however, to introduce the disease by entering into a lengthy detailed history of its early occurrence, identification, prevalence, etc. Suffice it to say, that there is hardly a State in the Union that can claim freedom from it among its flocks. For some time it had been mistaken for tuberculosis, the nodules, or tumors, on the intestines resembling, somewhat, the tubercles of consumption; but later investigation revealed the presence of a very minute round worm as the true cause.

The disease gets its name from the nodulated condition of the intestines, they being, in advanced cases, thickly studded with nodular enlargements all along their course, as far back as the last portion of the bowel (rectum). Everyone who has butchered sheep, in many sections of the country, must be familiar with the appearance, although, perhaps, ignorant of the cause of this condition, known popularly, in some localities, by the term, "knotty-guts."

In the adult stage, the worm, or parasite (Oesophagostoma Columbianum) is about one-half an inch in length, and may be found located in the intestines, and more particularly, the large bowel. The immature stages or forms, vary in length from 1-100 to 1-6 of an inch, depending upon age and stage of development. These are found encysted in the nodules. The writer has dissected quite a number of the larger, older, tumors, without finding the parasite in them, and from which we would infer that they had escaped into the intestine. The life-history of this minute worm, so far as appears to be known, from the more recent investigations, is as follows: The mature female lays her eggs in the intestine. The eggs hatch in a short time, and the embryos, or minute immature worms, pass, in some manner, through the mucous, or internal, lining of the bowel, and become encysted or embedded there; and the irritation produced by the worm seems to give rise to the nodules or tumors, which can be seen, of various sizes, projecting from the intestine, sometimes along its entire course.

INTESTINES SHOWING NODULE DISEASE.



The tumor consists of a cheesy material, often greenish in color, which, on breaking its outer covering, can be squeezed out. It is thought by Dr. Curtice that the embryos are the chief cause of the trouble, and that the adult worms produce but very little, as the latter are comparatively few as compared with the number of tumors. Some of the adult parasites, and probably some of the eggs, pass out from the intestines with the manure, and in this way pastures and other feeding quarters are infected; and in turn, shallow and sluggish watering places into which they drain. There is however, a stage in the life cycle of the worm that seems to be still undetermined. That is, from the time it leaves the bowels with the manure until it is again found in the tumors on the intestines.

The symptoms of nodular disease are not very characteristic during life. In fact, there must be thousands of fat sheep slaughtered annually in the abattoirs of the country affected with this ailment, which exhibit no special indications previous to being killed. But in the more advanced stages of the disease, the symptoms resemble those seen in other parasitic troubles, such as general debility and in the most severe cases rapid emaciation, and excessive diarrhoea. A positive diagnosis can only be made by post-mortem examination and finding the characteristic nodules on the intestines. The cause of death in acute cases is evidently the interference caused by the tumors to the process of absorption. Or, in other words, the animal is deprived of proper nutrition on account of the function of the intestinal walls being interfered with by the tumors, and the process of absorption of nutrient material thereby lessened. The extent of the derangement may be said to be in direct ratio to the number of tumors present.

The treatment so far suggested is chiefly preventive, although we believe the best results would be obtained from a combination of both preventive and curative, when handling an infected flock. The chief drawback to the desired effects of medicinal treatment is the embedded or encysted position of the parasites in the tumors which seem to be beyond the reach of medicines. Still, as adult worms are found free in the bowels, vermifuge medicines would necessarily have some effect upon those in this situation. The gasoline treatment, used in stomach-worm disease, has been recommended. A weak solution of creolin seems to have given favorable results in the hands of Dr. M. Jacob, of the Tennessee Experiment Station, a report of which he gave in a paper read before the United States Association of Experiment Station Veterinarians, at Atlantic City, N. J., in September, 1901. We quote from his paper the following: "Sheep had been dying at the rate of four or five a week. They had been put in a new field about six weeks previously, but still continued to die until after they had received, daily, about 20 minims of crude creolin per head. This was prepared in the form of a drench by dissolving 5 ounces of creolin in one gallon of water, and giving each sheep about one ounce a day for ten days. This treatment seemed to give pretty fair results, for during the next two or three months the death rate was very markedly decreased." Dr. Jacob thinks the treatment ought to be continued for at least one month. The individual treatment of sheep, where there are large numbers of them, is an undertaking which but few of our sheep owners in the State would attempt, except, perhaps, in the case of the animals being valuable purebreds. Dr. Cooper Curtice also states, however, "that in case medicinal remedies are tried, each animal must be dosed."

Those who are at all familliar with intestinal parasitic diseases are aware that medicinal treatment alone will not yield satisfactory results, but that other measures, outsides of the animal, must likewise be adopted. For, to attain our object, we must not only endeavor to destroy the parasites in the animal but we must also treat the infected pastures to destroy or render innocuous the parasites that may be on their surface, and capable of infecting animals (sheep in this case) grazing over them. A combination of both, then, is necessary for the most satisfactory results. Curtice remarks, "that the same care in changing pastures, in providing good drinking water and a plentiful supply of salt, should be observed in this disease as for other parasites. Judicious fall and winter marketing of infected sheep will also tend to lessen the chances of infection. If pastures are known to be permanently infected, then they should be turned over to other stock for a year or two before being again grazed on by sheep. When it is practical, on the smaller farms, the sheep lots should be plowed, and either planted or left fallow. The object of change of pasture and of plowing is nearly the same; in the one case to wait until the parasites have died out; in the other, to bury them beneath several inches of soil, from which the sheep owner may rest assured they will not emerge."

EXPERIMENTS.

In order to make a practical test of the question, for our own satisfaction, as to whether a pasture would become infected after being occupied by sheep affected with nodular disease, and the same pasture afterwards capable of transmitting the disease to healthy lambs, an experiment was commenced at the State Experiment Station on April 10, 1901, by confining three sheep from an infected flock on a small pasture lot, of about one-quarter of an acre in extent, which had not had sheep on it for at least thirteen years.

On February 2, 1902, one of the sheep died, after presenting the usual symptoms of internal verminous disease, such as general debility, emaciation, anaemia, etc., accompanied by loose bowels for two or three weeks previous. An autopsy revealed great numbers of nodules along the course of the intestines.

In order to obtain lambs free from nodular disease to place upon the pasture lot (after the infected sheep had occupied it from April 10, 1901, till about the beginning of May 1902), several pregnant ewes were purchased by the station and placed in a shed with floor kept clean and sprinkled over with sawdust. Grain was fed to them out of troughs, and green oats, or other soiling crop, out of racks, and they were watered from low-sided tubs or buckets. These ewes were suspected of having nodular disease and which proved to be the case, later, when autopsies were made.

After the lambs were born (between March 25th and April 19th, 1902) the following method was adopted in raising them until they were able to be placed on the lot with the infected sheep: A long shed was used, which was divided off into three compartments, with small gates between each. When separated, the ewes occupied one of the end compartments, and the lambs the other, leaving an empty one between. During the suckling periods the bars were lowered, and mothers and lambs allowed to come together in the middle compartment. As soon as nursing was over they were again separated into their respective compartments, and in this way were kept from one another, except during the suckling periods, to avoid contamination as much as it was possible.

Four lambs were saved out of half a dozen, two dying from the effects of cotton seed meal, which was an ingredient of a grain mixture fed when they were thought to be old enough to eat a little concentrated food.

On May 3rd and 5th a lamb, with its mother, was placed on the infected lot.

On July 24th the first lamb died. Post-mortem revealed a number of small nodules on the large intestine, and a tape-worm (taenia expansa) in the small bowel.

On August 22nd the second lamb died, and a number of small nodules were found on the large bowel; a tape-worm in the small bowel; and great numbers of twisted stomach worms in the fourth compartment of the stomach.

The autopsy on the first lamb that died was made by one of the college students during the temporary absence of the writer on State Farmers' Institutes, and stomach worms were not examined for. But it is our opinion that these worms were the cause of death in each case. Still, that did not vitiate the results of the test so far as nodular infection was concerned.

It should be stated that, although we commenced with only three infected sheep, we had as many as eight infected animals on the small lot during the time the two lambs were on it.

As a control experiment, the other two lambs, which were born and raised under similar conditions to the first two mentioned, were kept in a large clean box stall, were fed a little grain and green stuff (after they were weaned), and were afterwards staked out during the day on different parts of the horticultural garden, close by, but away from any opportunity of obtaining nodular infection.

These two lambs remained in a healthy condition and continued to thrive, weighing, together, 108 1-2 pounds, gross, when they were butchered on November 1st, 1902.

On post-mortem examination their intestines were absolutely free from nodules.

So far as this experiment goes, it simply substantiates the general opinion held by helminthologists, with respect to the entozoa (internal animal parasites), viz., that infection is spread to pastures through the medium of animals infested with parasites, and that previously sound animals may obtain the infection, afterwards, through grazing upon such pastures.

A knowledge of the fact, then, that a pasture may become infected through the medium of diseased sheep occupying it, and that sound lambs may obtain the infection by grazing upon it, either in company with infected sheep, or within a reasonable length of time after the latter have been removed, is of the utmost importance to our sheepowners. But, they should also be familiar with the more intelligent methods for the elimination of the infective agent (the parasite) from the pasture.

As may be inferred from the foregoing, a great many, probably the majority, of intestinal worms spend only a portion of their life-history in the body of the host on which they are parasitic, the other part being spent outside on the ground, or, sometimes, even in the body of some intermediate host, as is found to be so with tape-worms, fluke-worms, etc.

In the case of the minute round worm (nematode) which produces the nodules on the intestines of sheep, it would appear that, at least, some of the worms, or their eggs, escape with the bowel discharges on to the surface of the ground, and from there are taken up by other animals, causing, in sound ones, infestation, and, in the case of those previously diseased, re-infestation.

The inference to be deduced from this cursory glance at the life-history of intestinal parasites, such as the one under consideration, therefore, is, that, in addition to the administration of remedies directed to the destruction, or expulsion, of worms from the host in which they attain maturity, some treatment should be afforded the pasture that has become infected, and harbors the parasite in one or more of its stages. And, if this part of the treatment should be overlooked or neglected, the successful eradication of this, or other similar ailments of sheep, cannot reasonably be expected.

It was with the view of freeing the pasture of parasitic infection that the following experiment was undertaken, the details of which we now proceed to give.

The pasture-lot in which the experiments were conducted as before stated, is about one-quarter of an acre in extent, and fenced in with wire netting to protect its occupants from the possible ravages of dogs running at large. At the conclusion of the first experiment, this lot, which was then in an infected condition, was, on October 25th, 1902, ploughed up; considerable care being exercised during the operation to have the surface turned under as effectually as possible, and, close up to the fence bottom, where it was difficult, or impossible, for the plough to reach, a spade was used to complete the work over the entire area. The object aimed at in doing this was to bury the infection (worms, their eggs, or immature forms) beneath the sod so inverted.

On November 1st, 1902, this lot was sown to oats, from which an excellent crop was cut for hay on April 26th, 1903.

In order to again obtain a few sound lambs, that is, free from nodule disease of the intestines, to place upon the lot after the pasturage (Bermuda grass) had attained sufficient growth to afford them sustenance, three grade-ewes were procured from a farmer in a neighboring parish on April 3, 1903. One of the ewes came with a one-day-old lamb, the other two being within a short time of lambing. The flock from which these sheep were obtained had been affected with nodule disease for several years, at least, to the writer's personal knowledge. Similar preparations were made for the reception and care of this lot of ewes and lambs as for the bunch mentioned in the last experiment, viz., a shed divided into three compartments, connected by small openings with a gate on each. The two end compartments were occupied, respectively, by the ewes and the lambs, so as to keep them separate, except during the periods of nursing, when they were brought together in the center compartment (the floor of which was covered with sawdust and kept free from droppings all the time), and immediately separated again when suckling was over. The purpose here was to avoid, as in the previous case, contamination of the lambs through contact with the excrements from their mothers, or material they might eat, that should, perchance, have become soiled by parasites extruded with the manure.

On April 15th, the second lamb was born; and on the 18th, the third. Two of the lambs were grade-Dorsets; the other, a grade-Southdown.

Besides the mother's milk, to which they had access thrice daily, it not being convenient to permit of their suckling oftener, they were allowed a little green feed and a small quantity of crushed grain in their compartment, both of which they soon learned to eat and to relish.

On April 26th, the mother of the Southdown-grade lamb died from tetanus (lockjaw), the result of infection of a large wound produced by a projecting nail when the animal was rushing hurriedly through one of the gateways. So that the two remaining ewes had to take their share in supplying the orphan lamb with milk, and which they managed to do without any apparent difficulty.

On June 18th, the three lambs were turned out on the pasture lot, during the day only, sufficient growth having developed for them to graze on, and they were nursed in the morning, previous to turning out, and in the evening after being housed. This arrangement continued for a few days, when, on June 26th, the ewes went dry, and the lambs were allowed to remain in the lot from this time on, a small quantity of crushed grain and fresh water, given them daily, and they had a small, but suitable, temporary shed provided for protection against both rain and the excessive heat of the summer sun.

It will be noted that the lamb last born was just two months old when turned out; the others being 2 months and 3 days, and two and one-half months, respectively.

The lambs grazed regularly over the pasture lot, getting the little grain daily, as mentioned, to supply some of the nourishment (protein) for growth, of which they were deprived when the mother's milk was cut off, and were occasionally given a few sweet potato vines, of which they seemed passionately fond. They remained in perfect health, with no evidences, whatever, of parasitism, and on January 9, 1904, after being on pasture for a period of 6 months, 22 days (June 18, 1903 to Jan. 9, 1904), they were slaughtered and dressed by a local butcher, who purchased them. A careful post-mortem examination was made of the intestines of each lamb, but with negative results. That is, not the sign of a nodule could be found.

Some authorities have suggested the possibility, or even probability, of lambs obtaining infection from the mother's udder (bag) when nursing, the parasites being attached to some part of that organ. We do not doubt the possibility for this mode of transmission, when the ewes and lambs occupy pastures that are infected, the bag and teats of the mother coming in contact with the egg or worm infected ground. But, although all of the ewes from which we secured our experiment lambs were severely affected with nodule disease, none of the lambs, or, at all events, neither the two "controls", in the first part of the work, nor the three in the last part, could have been infected in this way, as proved by perfectly "clean" intestines when the autopsies were made. It may be, however, that the conditions, under which the ewes were kept with us, precluded the possibility of infection in this way. Yet, no special attention was paid to the absolute cleanness of the ewes compartment, and which was at times sufficiently foul with droppings to favor contamination of their bags and teats, when resting on the ground. Such, however, evidently did not occur in our case.

The conclusions deducible from the results of the experiments may be stated as follows:

(1). That sheep suffering from Nodular Disease of the Intestines, when placed upon a hitherto clean pasture, transmit infection to it through extrusion of the nodule-worm (Oesophagostoma Columbianum) from their bowels, probably with their droppings.

(2). That when sound lambs are permitted to occupy a pasture so infected, they will contract nodule disease.

(3). That when the surface of an infected pasture is turned under by ploughing, and the land cropped, even for a single season, the infection may be destroyed.

(4). That when sound lambs are allowed to occupy and graze upon a pasture (previously infected) after being cultivated and cropped, as above mentioned, they will remain free from nodule disease.

(5). That lambs, the progeny of ewes affected with nodule disease of the intestines, can be raised free from this disease, provided proper methods are adopted to prevent contamination, and,

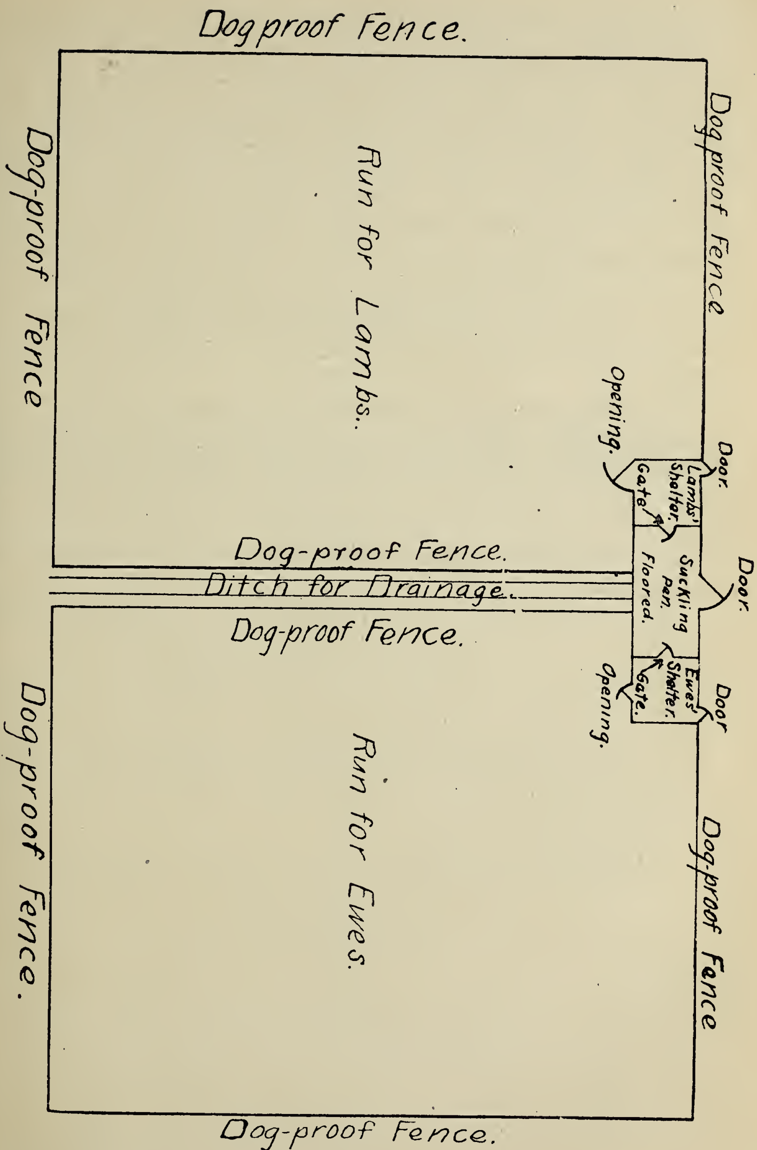
(6). That, if an infected pasture is placed in cultivation for a time, to destroy the parasites on it; clean lambs raised, as suggested by the method adopted by us, or purchased and known to be clean, and all affected sheep disposed of for slaughter (this ailment being confined to the intestines mainly, and not rendering the flesh unsafe as an article of human food), the disease may eventually be eradicated from both the land and the flock.

As stated above, these conclusions have been arrived at from the results of our experiment only. For further information with respect to Nodular Disease in Sheep, and its treatment in that animal, we would respectfully refer our readers either to our article on the subject in the first part of this bulletin, or to other works treating of this ailment.

Owing to the fact that probably the majority of sheep butchered in different parts of the State seem to show nodules on their intestines, it would appear that our old sheep pasture lands, or ranges, are very generally infected with the parasites of this disease; and so long as the sheep remain on these feeding grounds, so long will the disease exist, by the animals becoming infected, and, in turn, re-infecting the land and themselves. When the time comes, however, for such lands to be placed in cultivation, and take their part in a regular system of crop rotation, we will then have little difficulty in predicting the material reduction, if not the extermination, of this, as well as other internal parasitic diseases of the sheep. But, even under existing conditions, it is questionable whether it would not be more profitable to abandon the keeping of large flocks of diseased and scrubby animals on the old infected ranges, and have fewer, but better and more valuable ones of the improved breeds, on the farm—rather than on the range—where their feeding grounds could be periodically changed, which is inimical to the development of worms, and the sheep cared for and handled in an intelligent manner for the profit that may be obtained from them. Sheep husbandry is a profitable branch of agricultural industry, when conducted in a business-like way. But when sheep are neglected, there is no variety of domestic animal that will degenerate more rapidly, or succumb to the ravages of parasitic invasion more readily, with failure and loss as the inevitable result. Consequently, whoever hopes to succeed in the sheep-growing business, must become educated to its conditions and requirements, as has to be done by those engaged in, and make a success of, other branches of industry.

The following diagram and explanations also appeared in Bulletin No. 74, but as we deem these pertinent to the subject under consideration, their reproduction here will doubtless further add to the completeness of this report.

In order to suggest a practical method by which sound lambs may be obtained from infected mothers, we append the following diagram and suggestions:



GROUND PLAN.

First of all a piece of land should be chosen not previously occupied by sheep, on which to erect the shed and runs. The shed should be divided into three compartments, the ewes occupying one end and the lambs the other, the middle one being kept for a suckling pen, as previously described. The floor of the compartments should be such that it can be easily cleansed and kept free of accumulated manure, and any material that would harbor the parasites. Two runs should be constructed at right angles to the shed, one connected with the ewes' compartment, the other with the lambs', while a space should remain between the runs, sufficiently wide to prevent contamination from the ewes to the lambs. Each run should be protected with dog-proof fencing, and both should be thoroughly drained, with the object, first, of preventing infection (the parasites) being washed from the ewes' run to the lambs'; and second, of keeping both dry. The size of the construction would have to be determined, of course, by its requirements.

After raising a crop of sound lambs each year, by this, or other suitable method, the diseased ewes could be gradually disposed of by marketing, and the infection lessened in this way from time to time. And, if the lambs, after weaning, were placed upon sound pasture, or other provision made for them, it need not be long before a sound flock might be raised from one badly affected with nodular disease.

SECOND SERIES, NO. 80.

BULLETIN

OF THE

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

W. C. STUBBS, PH. D., Director and State Chemist.

Analyses of Commercial Fertilizers and Paris Green.

ISSUED BY THE LOUISIANA STATE BOARD OF AGRICULTURE
AND IMMIGRATION.
J. G. LEE, COMMISSIONER.

LOUISIANA STATE UNIVERSITY
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Louisiana State University and A. and M. College,
Office of State Experiment Station,
Baton Rouge, La., September 1, 1904.

Major J. G. Lee, Commissioner of Agriculture and Immigration,
Baton Rouge, La.

Dear Sir:—I hand you herewith analyses of Commercial Fertilizers and Paris Greens, made in the laboratories of the Station since last season.

Respectfully submitted,
WILLIAM C. STUBBS,
Director and State Chemist.

REPORT OF THE DIRECTOR AND STATE CHEMIST.

The analyses of Commercial Fertilizers contained in this report are of four kinds:

1. Samples selected at the discretion of the Commissioner of Agriculture and inspectors for purposes of inspection.
2. Samples drawn by the purchaser, under regulations prescribed by the Commissioner of Agriculture:

The above are required by law.

3. Samples used by the Stations.
4. Samples sent by private parties.

While the Station is not required by law to work for private parties, yet all samples sent by individual citizens of the State will be analyzed without charge; *provided,* the means of the Station will permit; *provided,* always, that in the discretion of the Director such analysis will be conducive to public welfare.

The fertilizer law, in full, is herein inserted for the guidance of the public. Under it, every citizen of the State is amply protected from fraud and imposition by unscrupluous dealers, and there exists absolutely no cause for distrust in the purchase of commercial fertilizers, if the farmer will but claim the protection afforded him. The sellers of good wares are also protected, as ample facilities are afforded them of properly advertising their goods.

The following is the law:

SECTION 1. Be it enacted by the General Assembly of the State of Louisiana, that the State Board of Agriculture and Immigration shall have power to make and establish rules to carry out the designs and purposes of this act, and in conformity thereto, for the purpose of maintaining effective control of the manufacture and sale in this State of commercial fertilizers and for the suppression of adulteration and fraud therein, as authorized by Article Three Hundred and Six (306) of the Constitution of the State of Louisiana.

Sec. 2. Be it further enacted, etc., That it shall be the duty of any manufacturer or dealer in, or any person soliciting orders, whether by sample or otherwise or whether such orders are to be accepted by him or his principal for the sale of any commercial fertilizer (which term shall not be held to include lime, land plaster, cotton seed meal, ashes or common salt), before the same is offered for sale in this State, to submit to the Commissioner of Agriculture and Immigration for inspection and analysis fair samples of the same, which shall be analyzed by the official chemist, and to furnish a written or printed statement setting forth: First—The name and brand under which said fertilizer is to be sold, the number of pounds contained or to be contained in the package in which it is to be put upon the market for sale, and the name of the manufacturer and the place or places of manufacture; second, a statement setting forth the amount of the named ingredients which he or they guarantee said fertilizer to contain (1) nitrogen, (2) soluble phosphoric acid; third, reverted phosphoric acid; fourth, insoluble phosphoric acid; fifth, potash. Said statement so to be furnished, accompanied by a sample or samples of the fertilizer to be inspected, and which shall be analyzed by the official chemist, shall be considered as constituting a guarantee to the purchaser that every package of such fertilizer contains not less than the amount of each ingredient set forth in the statement and contained in the sample or samples. This shall, however, not preclude the party making the statement from setting forth any other ingredients which his fertilizer may contain, which additional ingredients shall be considered as embraced in the guarantee above stated. That an inspection fee of twenty-five cents per ton upon any fertilizer sold for use in this State shall be paid by the seller, solicitors or agents, etc., thereof to the Commissioner of Agriculture and Immigration, which inspection fee shall cover the cost of inspection and analysis made by the commissioner or the official chemist, or at the request of either the seller or the buyer, and the certificate to be furnished by the commissioner. Payment of said inspection fee shall be evidenced by tags to be furnished by the Commissioner of Agriculture and Immigration sufficient in number to place one upon each package of fertilizer required to make up a ton according to the way in which each particular fertilizer may be packed and shipped.

SEC. 3. Be it further enacted, etc., That every person proposing to deal in or solicit orders for the sale of commercial fertilizers in the State of Louisiana, shall, after submitting the sample or samples of fertilizer or fertilizers for inspection and analysis, and filing the statement above provided for with the Commissioner of Agriculture and Immigration, receive from the said commissioner a certificate stating that he has complied with the foregoing section, which certificate shall be furnished by the commissioner without any additional charge therefor. That the said certificate when furnished shall authorize the party receiving the same to manufacture for sale in this State, to solicit orders for the sale of, or to deal in this State in commercial fertilizers or to sell fertilizers for use in this State. Any person manufacturing, dealing in, selling or soliciting orders in the State of Louisiana, for the sale of commercial fertilizers, shall, when he has agreed to sell any lot of said fertilizers, notify in writing, before delivery or shipment to the purchaser thereof, the nearest fertilizer inspector of the sale, the amount of the lot sold, the names of the seller and purchaser, and the location and situation of the lot of fertilizers so sold, and when so notified the inspector of fertilizers shall proceed to sample said lot, and shall forward to the commissioner such sample for analysis, with the names of the vendor and vendee, the brand of fertilizer, the weight and description of the packages, the name of the manufacturer, the place of manufacture, and the marks on said packages, and the vendor shall not ship or deliver the lot or lots sold to the purchaser until such inspector has made such inspection, provided that in the event the inspection before shipment or delivery to the purchaser be found to be impracticable, then said inspection shall be made immediately after actual delivery to the purchaser, or so soon thereafter as practicable under the circumstances. In order to provide for said inspection the commissioner shall appoint inspectors in the various portions of the State, and shall publish the names of said inspectors and their postoffice addresses, to whom such notification shall be sent and by whom said inspection shall be made. That no person who has failed to file the statement aforesaid and to receive the certificate of authority aforesaid, shall be authorized to manufacture for sale in this State or to deal in commercial fertilizers, or to sell or solicit orders for the sale of fertilizers for use in this State, and any person so manufacturing for sale in this State, or so dealing or selling or soliciting orders therefor for use in this State, without having submitted his fertilizers for inspection and analysis and filed the aforesaid statement and receiving the certificate aforesaid, shall be liable for each violation to a fine not exceeding five hundred dollars ($500), which fine shall be recoverable before any court of competent jurisdiction, at the suit of the commissioner or any citizen, without bond or advanced cost, and shall be disposed of as hereinafter provided.

Sec. 4. Be it further enacted, etc., That it shall be the duty of the Board of Agriculture and Immigration or its commissioner, at the opening of each season ,to issue and distribute circulars setting forth the brands of fertilizers sold in this State, their analysis as claimed by their manufacturers or dealers and their relative and, if known, their commercial value.

Sec. 5. Be it further enacted, etc., That it shall be the duty of the commissioner to cause to be prepared tags of suitable material, with proper fastenings for attaching the same to packages of fertilizers, and to have printed thereon the word "Guaranteed," with the year or season in which they are to be used, and a fac-simile of the signature of the said commissioner. The said tags shall be furnished by said commissioner to any dealer or solicitor or manufacturer of commercial fertilizers who shall have complied with the foregoing provisions of this act upon the payment by said dealer, manufacturer or solicitor to the said commissioner, of twenty-five cents for a sufficient number of tags to tag a ton of such commercial fertilizer, as evidence of the payment of the inspection fee provided for in section 2.

Sec. 6. Be it further enacted, etc., That it shall be the duty of every person, before selling any commercial fertilizers in this

State or for use in this State, to attach or cause to be attached to each bag, barrel or package thereof one of the tags herein before described, designating the quantity of the fertilizer in the bag, barrel or package to which it is attached, as evidence of the payment of the inspection fee imposed by section 2. Any person who shall sell any package of commercial fertilizer which has not been tagged as herein provided, shall be guilty of a misdemeanor, and on conviction thereof, shall be fined in the sum of two hundred and fifty dollars ($250) for each lot of fertilizers so sold; and the said person shall be besides liable to a penalty of five dollars ($5) for each omission to tag each package, each omission to constitute a separate offense, which penalty may be sued for either by the commissioner or any other person for the uses hereafter declared. And it shall be the duty of the Attorney General and of the several District Attorneys when requested by the commissioner, to enjoin any person, firm or corporation, resident or non-resident, from manufacturing or selling or soliciting orders for the sale of fertilizers in this State or selling fertilizers for use in this State without complying with all the provisions of this act, without bond or advanced cost. Any person who shall counterfeit or use a counterfeit of the tag prescribed by this act, knowing the same to be counterfeited, or who shall use them a second time after the said tags have been once attached, shall be guilty of a misdemeanor, and on conviction thereof shall be fined in a sum not exceeding five hundred dollars ($500), one-half of which fine shall be paid to the informer; which fine may be doubled or tripled at each second or third conviction, and so on progressively for subsequent conviction.

SEC. 7. Be it further enacted, etc., That all fertilizers or chemicals manufactured for use as fertilizers, offered for sale or distribution in this State, shall have printed upon or attached to bag, barrel or package, in such manner as the commissioner may prescribe the true analysis of such fertilizer or chemical as claimed by the manufacturer, showing the per cent of valuable ingredients such fertilizers or chemicals contained, as set forth in section second of this act. And for each and every omission so to print upon or attach to each bag, barrel or package, the offender shall be liable to a fine of one dollar ($1.00) for each package so sold, recoverable by civil suit by the commissioner or any person in a court of competent jurisdiction, said fines and penalties when recovered to go to the uses hereinafter specified in this act.

Sec. 8. Be it further enacted, etc., That the commissioner shall have a privilege on any commercial fertilizers sold in this State or sold for use in this State in violation and contravention of the provisions of this act, and may proceed by writ of provisional seizure against the fertilizers so sold in the hands of whomsoever they may be, and wheresoever he may find them, regardless of the domicile of the owner thereof, to rcover the fines and penalties due for the illegal sale thereof, by presenting a petition to a competent judge or magistrate, within whose jurisdiction said fertilizers are found, stating on oath at the foot of the petition the amount and nature of the demand, the fertilizer on which the privilege exists, and praying that the fertilizer be seized to satisfy the claim and pay the costs of suit, and thereafter the proceeding in said suit or suits shall be conducted in the manner provided for in Articles two hundred and ninety-two (292), two hundred and ninety-three (293), two hundred and ninety-four (294) and two hundred and ninety-five (295) of the Code of Practice, all of which are hereby made applicable to the proceedings herein provided for, provided that if there be judgment in favor of plaintiff in such suits, with privilege on the fertilizers, and the same be ordered to be sold to satisfy such judgment, the commissioner shall, prior to said sale, draw proper samples from said fertilizers, and cause the same to be analyzed by the official chemist, and shall affix to the packages thereof the guarantee tags as required by this act, so that the purchaser at the sheriff's or constable's sale may purchase the said fertilizers under a full guarantee, as provided for in this act.

Sec. 9. Be it further enacted, etc., That the commissioner may inspect, or cause to be inspected, and may obtain, or cause to be obtained, at his discretion, fair samples of all fertilizers sold or offered for sale in this State, or offered for sale or sold for use in this State, and shall have them analyzed by the official chemist, and shall publish the analysis for the information and protection of the public.

SEC. 10. Be it further enacted, etc., That it shall be the duty of every person who sells a lot or package of commercial fertilizer, upon the request of the purchaser to draw from the same, in the presence of the pruchaser or his agent, a fair and correct sample in such a manner as the commissioner shall prescribe, and submit the same for inspection as hereinafter provided.

SEC. 11. Be it further enacted, etc., That no fraudulent fertilizers shall be sold for use in this State; that the price of fraudulent fertilizers shall not be collected by any process of law; that no person buying fraudulent fertilizers in this State or sold for use in this State shall be bound in any manner to pay the price or cost thereof; that all fertilizers sold in this State or for use in this State without having been inspected or tagged as provided for in this act shall be conclusively presumed to be fraudulent fertilizers, within the meaning of this prohibitory law, the price of which shall not be collected, and all notes, contracts and obligations based on the sale thereof shall be null and void.

SEC. 12. Be it further enacted, etc., That the commissioner shall prescribe the rules and regulations providing for the inspection of fertilizers; shall collect the monies arising from the issuance of tags as evidence of inspection, and from fines imposed under this act, and shall require the same to be deposited with the Treasurer of this State, and only to be drawn therefrom upon the warrants issued by the Auditor of the State upon the requisition of the commissioner; and the said commissioner shall be entitled to receive no fees for collecting or disbursing said money, except his salary, as provided for by law, but he shall be allowed, if needed, a clerk at the salary to be fixed by the said Board of Agriculture and Immigration not to exceed $1,200 per annum and payable out of the Fertilizer Fund; and all sums of money arising from the provisions of this act shall be known as the "Fertilizer Fund," and shall be kept by the Treasurer separate from other public funds, and shall be exclusively used, as far as they may go, to defray the expenses of inspection and analysis herein required, and of making practical and scientific experiment with fertilizers to test their virtue and value.

SEC. 13. Be it further enacted, etc., That the net proceeds of all inspection fees imposed by this act, and of all fines and penalties collected under this act (of all which the commissioner shall keep a correct and detailed account) constituting the Fertilizer Fund, shall be divided between the State Experiment Station at Baton Rouge, the Sugar Experiment Station, at New Orleans, and the North Louisiana Experiment Station, at Calhoun, Louisiana, to be used for the purpose herein designated as compensation for all analysis, tests and exeriments required. That the director of said stations shall be the official chemist of the Louisiana State Board of Agriculture and Immigration; he shall have made all analyses required or authorized under this act and shall attend all chemical and agricultural conventions, the leading objects of which are to discuss questions pertaining to fertilizers. He shall perform such other duties as may be imposed by this act without compensation other than the benefits which may be derived by the stations from their participation in the said Fertilizer Fund as hereinbefore directed, except his traveling exenses in attending said conventions, which shall be paid out of the Fertilizer Fund.

SEC. 14. Be it further enacted, etc., That Act No. 72, of 1894, be and the same is hereby repealed in so far as it might operate in the future; but as to the offenses committed, liabilities already incurred, and claims now existing thereunder, it shall be and remain in full force and effect.

AN ACT

To amend and re-enact Sections 1 and 2 of Act No. 126, of 1898, entitled "An Act to carry into effect Article 306 of the Constitution of the State of Louisiana; to define the duties and powers of the State Board of Agriculture and Immigration, and those of the Commissioner of Agriculture and Immigration in relation to the suppression of adulteration and fraud in the sale of commercial fertilizers in conformity therewith;

to provide for the inspection and analysis of all commercial fertilizers sold for use in the State of Louisiana, and for the payment by the seller of the inspection fees therefor; to authorize the appointment of fertilizer inspectors, to provide for guarantees of the component chemicals contained in fertilizers, and the affixing of tags to the packages thereof as evidence of the guarantee and inspection thereof; to prohibit the sale of illegal or fraudulent fertilizers in violation of the provisions of this Act, and affixing fines and penalties for the violation of the provisions of this Act; to provide for judicial proceedings *in rem* against fertilizers sold in contravention of this Act; to give the Commissioner of Agriculture and Immigration a privilege thereon, and the right to the writ of provisional seizure to conserve said privilege, and to define the methods of said procedure; to provide for suits for the recovery of fines and penalties and injunction under this Act, to provide for the distribution and expenditure of the fees and penalties collected under the provisions of this Act, and their appropriation to fertilizer experiment purposes, and to repeal Act No. 72, of 1894, in so far as it might operate in the future."

Approved July 13, 1898.

Section 1. Be it enacted by the General Assembly of the State of Louisiana, That section 1 of said Act, No. 126 of the regular session of the General Assembly of 1898, approved July 13, 1898, be amended and re-enacted so as to read as follows:

Section 1. That the State Board of Agriculture and Immigration shall have power to make and establish rules to carry out the designs and purposes of this Act, and in conformity thereto, for the purpose of maintaining effective control of the manufacture and sale in this State of all commercial fertilizers and cotton seed meal when sold or offered for sale as a fertilizer, and for the suppression of adulteration and fraud therein, as authorized by Article 306 of the Constitution of the State of Louisiana.

Sec. 2. Be it further enacted, etc., That Section 2 of said Act No. 126, of 1898, be amended and re-enacted so as to read as follows:

Sec. 2. That it shall be the duty of any manufacturer or dealer in fertilizers, or any person soliciting orders, whether by sample or otherwise, or whether such orders are to be accepted by him or his principal, for the sale of any commercial fertilizer (which term is intended to and shall include cotton seed meal when sold or offered for sale as a fertilizer, but shall not include lime, and plaster, ashes or common salt), before the same is offered for sale in this State, to submit to the Commissioner of Agriculture and Immigration for inspection and analysis fair samples of the same, which shall be analyzed by the official chemist, and to furnish a written or printed statement setting forth: first, the name and brand under which said fertilizer is to be sold, the number of pounds contained or to be contained in the package in which it is to be put upon the market for sale, and the name of the manufacturer and the place or places of manufacture. Second, a statement setting forth the amount of the named ingredients, which he or they guarantee said fertilizer to contain—(1) nitrogen, (2) soluble phosphoric acid, (3) reverted phosphoric acid, (4) insoluble phosphoric acid, (5) potash. Said statement to be furnished accompanied by a sample or samples of the fertilizer to be inspected, and which shall be analyzed by the official chemist, shall be considered as constituting a guarantee to the purchaser that every package of such fertilizer contains not less than the amount of each ingredient set forth in the statement and contained in the sample or samples. This shall, however, preclude the party making the statement from setting forth any other ingredients which his fertilizer may contain, which additional ingredients shall be considered as embraced in the guarantee above stated. That an inspection fee of twenty-five cents per ton upon any fertilizer sold for use in this State, shall be paid by the seller, solicitor or agents, etc., thereof, to the Commissioner of Agriculture and Immigration, which inspection fee shall cover the cost of inspection and analysis made by the commissioner or the official chemist, or at the request of either the seller or the buyer, and the certificate to be furnished by the Commissioner. Payment of said inspection fee shall be evidenced by tags to be furnished by the Commissioner of Agriculture and Immigration sufficient in number to place one upon each package of fertilizer required to make up a ton according to the way in which the particular fertilizer may be packed and shipped.

COMMERCIAL FERTILIZERS.

All fertilizers sold on our markets are valuable just in proportion to the quantity and quality of the following ingredients, which they may contain, viz: Nitrogen (ammonia), phosphoric acid and potash. A fertilizer may contain one or two, or all of these ingredients, and may consist of (1) nitrogen (ammonia) alone, (2) phosphoric acid alone, (3) potash alone, (4) nitrogen (ammonia) and phosphoric acid, (5) phosphoric acid and potash, (6) nitrogen (ammonia) and potash, (7) nitrogen (ammonia), phosphoric acid and potash.

No. 7 is a complete fertilizer, *i. e.,* furnishing all three of the ingredients. These ingredients are combined in different proportions to suit the wants of different crops and different soils. No. 6 is rarely found in Southern markets, since nearly all Southern soil require phosphoric acid, and its absence renders it unadapted to wants of the farmer. The others are all found in our trade centers.

1ST—NITROGEN MANURES.

Nitrogen is the most fugitive as well as the most costly ingredient of fertilizers. It unites chemically with three parts of hydrogen to form ammonia (hartshorn or shops); every fourteen parts of nitrogen making seventeen parts by weight of ammonia. It also unites with oxygen to form the basis of nitric acid, two parts of nitrogen requiring five parts of oxygen, and this combination dissolved in water gives nitric acid, a form into which (it is believed) that all organic nitrogen must be dissolved before it can serve as plant food. Nitrogen is offered to the trade in three forms, viz:

(a) Mineral nitrogen in nitrate of soda (containing when pure over 16 per cent nitrogen), nitrate of potash (14 per cent), and sulphate of ammonia (21 per cent).

(b) Animal nitrogen in dried blood, tankage, azotin, cracklings, fish scrap, leather, wool waste, etc.

(c) Vegetable nitrogen in cotton seed, cotton seed meal, linseed meal, castor pomace, and peat.

Blood, tankage, fish scrap, and oil meals are highly active fertilizers, while leather, wool waste and peat are very slowly available.

In the North and England the mineral forms, particularly nitrate of soda and sulphate of ammonia, are largely used for top dressing small grains and grasses, as well as in combinations with phosphoric acid and potash to make complete fertilizers for general use and are very highly esteemed. In the South, on account of the fear of loss by leaching from the soil, they are used with greater care and in much less quantities.

Cotton seed meal contains, besides nitrogen, small amounts of phosphoric acid and potash. A fair sample of meal, *free from hulls,* should yield 7 per cent nitrogen, 3 per cent phosphoric acid and 2 per cent potash. This is a cheap source of nitrogen, and experiments have demonstrated that it is, perhaps, the best form for Southern agriculture. In buying it, however, *caution* is necessary to see that it is well decorticated, *i. e.,* free from hulls. Samples containing 30 per cent of hulls have been found on the market.

(2) PHOSPHORIC ACID MANURES.

These are generally phosphate rocks treated with sulphuric acid. Sometimes pure bones or bone black, or bone ash, are treated with the same acid, and resulting mixtures styled dissolved bones or superphosphates. When made from phosphatic rock, bone black or bone ash, they contain only phosphoric acid. When pure bones are used, 3 to 5 per cent of ammonia is also found. These phosphatic manures usually contain their phosphoric acid in different forms. Some of it is readily soluble in water, and is highly available as plant food; some of it is only soluble in acids, and is, therefore, only slowly, if at all, available to plants, while another portion is intermediate in solubility between the water soluble and the acid soluble. The chemist uses citrate of ammonia to dissolve this form; and hence it is denominated as citrate soluble phosphoric acid. It is believed by many that this form of phosphoric acid has resulted from a chemical action of the water soluble upon the acid soluble, and hence it is often called *"reverted," "reduced,"* etc. The water soluble is readily available on all soils and by all plants; the citrate soluble in soils containing vegetable matter, is believed to be available to many plants, while the acid soluble is not immediately useful to most soils. The water soluble and citrate soluble are usually taken together and called available phosphoric acid. In buying phosphatic manures, preference should be given, first to the water soluble, then to the citrate soluble. These three forms of phosphoric acid are usually called "soluble," "reduced" and "insoluble."

(3) POTASH MANURES.

Formerly ashes were the only commercial source of potash, and even now are to be found on the market in the form of wood ashes and cotton seed hull ashes. The latter are in great demand by the tobacco growers of Connecticut. But ashes of all kinds have been nearly supplanted by the cheap and excellent potash manures from Stassfurth and Leopalshall, Germany, which are now sold in every market. The German Kali works have established an headquarters in this country, and are supplying the trade with every desirable form of potash. Those forms sold usually in the South are:

(a) Kainite, the crude product of the mines, and contains, besides, potash, magnesia, soda, sulphuric acid and chlorine. This form is largely used in a compost of stable manure, cotton seed and acid phosphate prepared at home by the cotton farmer, or mixed acid phosphates and nitrogenous manures by the manufacturers for cotton fertilizers. It is extremely doubtful whether most Southern soils need potash; and every farmer should determine the question experimentally on his own soil before making excessive purchases of this ingredient. When potash is needed this is a cheap and excellent source, containing about 12 per cent.

(b) Sulphate of potash, a refined product, containing a large amount of potash in a very desirable form, is extensively used in some countries, upon certain crops, notably tobacco and Irish potatoes.

(c) Muriate of potash, another refined product, containing a large percentage of potash. This salt furnishes potash in the cheapest form.

(4) NITROGEN AND PHOSPHORIC ACID.

Formerly a large number of fertilizers were found on our markets containing only these two ingredients, but recently, however, potash in some form has been added to them all. This addition has been made either to meet the requirements of the farmers or the inclination of the manufacturers to furnish complete fertilizers. Potash is cheap, and any demand for it is readily supplied. In Louisiana, where the use of potash manures have been found to be of little or no profit, two fertilizers have become extremely popular and are extensively used, viz: tankage and a mixture of cotton seed meal and phosphate. Both may properly be located under this division, though strictly speaking the *mixture* would be excluded by virtue of the small content of potash in the cotton seed meal. The *mixture,* made in different proportions to suit different crops upon different soils, is very extensively used all over the State and gives general satisfaction. It also furnishes these two ingredients (nitrogen and phosphoric acid) in their cheapest and best forms.

Tankage is extensively used under sugar cane. It contains from 4 per cent to 12 per cent of nitrogen and 6 per cent to 20 per cent of phosphoric acid. It is a mixture of blood, meat, bones, etc., of the slaughter houses (from which the fat has been extracted), dried and pulverized. Its composition varies between wide limits, whether the blood and meat or the bones predominate. If the former, the nitrogen is high, and if the latter, phosphoric acid. It is the nitrogen which gives it its chief value, and the larger the quantity of this, derived from blood or meat (both highly available forms of nitrogen) the more responsive it becomes as a fertilizer. Neither the nitrogen nor the phosphoric acid in bones are readily available on most of our soils. Hence in buying tankage great care should be exercised to obtain as large a nitrogen content as possible.

Fish scrap might also be included under this head, since it contains only nitrogen and phosphoric acid, but so little is sold in this State as to merit only this passing remark.

Ground bones (raw and steamed) may also be included here. They are used to some extent by the truck growers of East Louisiana, and should be subjected to the same inspection as other fertilizers before use. Ground bones depend primarily for their value upon physical and chemical properties. They should contain from 3 to 5 per cent nitrogen and 20 to 24 per cent phosphoric acid and be very finely ground. They are slowly available at best, and hence in using them with expectation of early returns, care must be exercised in securing them *very finely ground.*

(5) PHOSPHORIC ACID AND POTASH.

To make acid phosphates suitable for composting, many dealers have recently added potash. This addition necessarily lowers the percentage of phosphoric acid. Manufacturers in and around Charleston, S. C., have adopted the custom of calling this class of goods "Acid Phosphates," and those which contain no potash, "Dissolved Bones." These are extensively used in Georgia for the compost of stable manure and cotton seed, but in this State the pure acid phosphates has given very satisfactory results in the compost.

(6) NITROGEN AND POTASH.

The great and crying want of Southern soils is phosphoric acid; hence no manure without it has hitherto met with favor. Accordingly this class of manures is rarely met with in the South.

(7) COMPLETE MANURES.

Containing nitrogen, phosphoric acid and potash, constitute the bulk of the commercial fertilizers offered to the trade. These are generally manipulated out of the different forms described under the previous heads, combined in such proportions as to meet the imagined or real wants of certain crops. For cotton they usually contain from 2½ to 3 per cent nitrogen, 8 to 12 per cent available phosphoric acid and 2 to 3 per cent potash. For corn and cane the quantity of nitrogen is greatly increased, with a corresponding decline in phosphoric acid. Many Southern manufacturers of fertilizers are making most excellent wares, mixtures of cotton seed meal and phosphates and kainite. These mixtures, varying in porportion only, are applicable to most every crop grown in this latitude and are sold at prices satisfactory to buyers.

CAUTIONS IN BUYING FERTILIZERS.

Before purchasing, a farmer or planter should know the requirements of his crop and soil, and then buy only such manures as will supply them. Then get the dealer or manufacturer to answer the following questions:

How much soluble phosphoric acid do you guarantee?

How much reverted phosphoric acid do you guarantee?

How much nitrogen or ammonia do you guarantee?

How much potash do you guarantee?

With the reply to these questions one can easily calculate the approximate commercial value of a ton of the goods desired.

In a plain acid phosphate at least 12 per cent available phosphoric acid should be guaranteed.

In cane fertilizers, 3 per cent nitrogen and 7 per cent available phosphoric acid, and in cotton fertilizers 2 per cent nitrogen and 8 per cent available phosphoric acid should be the least quantities accepted.

VALUATION OF FERTILIZERS.

The commercial value of a fertilizer is regulated by the prices demanded in commerce for the different forms of the three ingredients, nitrogen (ammonia), phosphoric acid and potash. These prices fluctuate according to the demand and supply. In some parts of the North, nitrogen is assigned a separate valuation for each of its forms—that in nitrates and ammonia salts receiving the highest figure, and in leather and peat, the lowest.

In Connecticut and Massachusetts, a determination of the forms in which this ingredient occurs must be made before its commercial value can be calculated. All the forms of nitrogen have heretofore been considered of equal money value in the South and but one price assigned. This, of course, precludes the existence of nitrogen in form of leather dust, or powdered horn, forms regarded as unavailable and of little money or agricultural value.

The soluble and reverted forms of phosphoric acid have together been styled as ''available,'' and assigned one value. The insoluble phosphoric acid has received no valuation. All forms of potash soluble in water have been regarded as of equal value.

The following tariff of prices has been adopted for the past and coming season:

Nitrogen, 16 cents per pound, which makes ammonia 13 1-10 cents per pound.

Soluble phosphoric acid, 5 cents per pound.

Reverted phosphoric acid, 5 cents per pound.

Potash, 5 cents per pound.

The above prices may be used to illustrate the method by which the commercial value of a fertilizer may be approximately estimated, *e. g.:* A fertilizer containing by analysis the following:

Nitrogen, 3 per cent; soluble phosphoric acid, 6 per cent; reverted, 4 per cent; potash, 2 per cent. What is the approximate commercial value per ton?

A ton will contain:

60	pounds nitrogen, 16 cents	$9.60
120	" soluble phosphoric acid, 5 cents	6.00
80	" reverted phosphoric acid, 5 cents	4.00
40	" potash, 5 cents	2.00
	Value per ton	$21.60

In this way the approximate value of any commercial fertilizer can be estimated. These prices are by no means fixed. They fluctuate almost daily in the markets of the world in accordance with the law of supply and demand. But the tariff given is believed to be nearly representative of the average of prices during the past year, and hence are adopted for the ensuing season.

LABORATORY WORK.

The following number of analyses have been made during the season just ended in the laboratories of the Stations:

Complete Fertilizers	2,409
Tankages	317
Bone Meals	239
Acid Phosphates	408
Cotton Seed Meals	824
Acid Phosphates, with Potash	60
Miscellaneous	76
Private samples, etc	47
Total analyses	4,380

AMMONIATED SUPERPHOSPHATES AND GUANOS.

Ammoniated superphosphates and guanos constitute the chief bulk of the fertilizers consumed by the farmers of the Southern States. The term "complete fertilizer" is often applied to them on account of the fact that they contain all three of the most essential fertilizing constituents, and their range of adaptaiblity is, in consequence, much greater than that of any of the partial manures. As might be supposed, there is great diversity in the composition of fertilizers of this class, both as regards the proportions of the fertilizing ingredients and also the forms in which they are supplied, the quantities of these essential constituents being so regulated as to correspond with the manufacturer's ideas as to the demands of our principal crops.

The following were analyzed:

Number of Samples.	Name of Manufacturer and Brand.	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Sol-uble	Reverted	Insoluble	Total	Available			
	ARCADIA COTTON OIL MILL & MANUFACTURING CO., ARCADIA, LA.								
	CORN FERTILIZER.								
	Guarantee	....	....	....	....	7.00	3.50	4.25	1.00
7	Average of analyses	6.23	3.50	1.21	10.94	9.73	3.80	4.61	1.00
	All samples up to guarantee.								
	COTTON FERTILIZER.								
	Guarantee	....	....	....	....	10.50	1.75	2.12	.50
4	Average of analyses	9.52	4.56	.62	14.70	14.08	2.18	2.65	.40
	Four samples below guarantee in potash.								
	POOR LAND.								
	Guarantee	....	....	....	....	4.00	5.50	6.68	1.50
2	Average of analyses	3.13	3.32	.39	6.84	6.45	6.06	7.35	1.03
	Two samples below guarantee in potash.								
	ARMOUR FERTILIZER WORKS, KANSAS CITY, KAN., AND CHICAGO, ILL.								
	PLANTATION SPECIAL.								
	Guarantee	....	....	2.50	6.50	4.00	7.00	8.50	....
11	Average of analyses	....	....	3.12	9.30	6.18	7.36	8.93	....
	Maximum	....	....	5.57	13.50	7.93	7.62	9.25	....
	Minimum	....	....	1.45	6.80	4.30	6.74	8.18	....
	Two samples below guarantee in nitrogen.								
	Nine samples up to or above guarantee.								

	CAPITAL FERTILIZER CO., JACKSON, MISS.								
	NONPAREIL.								
	Guarantee	7.50	2.00	1.00	10.50	9.50	1.65	2.00	2.25
11	Average of analyses	7.77	3.03	.97	11.77	10.80	1.55	1.88	2.50
	Maximum	8.40	3.63	1.30	13.33	12.03	1.58	1.94	2.73
	Minimum	7.15	2.43	.64	10.22	9.58	1.52	1.84	2.28
	Eleven samples below guarantee in nitrogen.								
	FEDERAL CHEMICAL CO., WEST NASHVILLE, TENN.								
	DAYBREAK.								
	Guarantee	6.00	2.00	1.00	9.00	8.00	1.65	2.00	2.00
1	Analysis	7.11	4.80	1.70	13.61	11.91	1.65	2.00	1.55
	Below guarantee in potash.								
	HAZLEHURST OIL MILL & FERTILIZER CO., HAZLEHURST, MISS.								
	IMPERIAL.								
	Guarantee	7.00	2.00	1.00	10.00	9.00	1.65	2.00	1.50
47	Average of analyses	7.85	2 90	1.37	12.12	10.75	1.70	2.06	1.98
	Maximum	8.00	3.65	1.70	13.30	11.60	1.73	2.10	2.17
	Minimum	7.60	2.49	1.10	11.59	10.28	1.68	2.04	1.81
	All samples up to guarantee.								
	DIAMOND "A," VEGETABLE GROWER.								
	Guarantee	5 00	1.50	1.00	7.50	6.50	2.00	2.43	3.00
2	Average of analyses	3.20	2.03	.95	6.18	5.23	3.10	3.76	4 20
	Two samples below guarantee in available phosphoric acid.								
	SUPERIOR.								
	Guarantee	7.00	2.00	1.00	10.00	9.00	1.65	2.00	1.50
1	Analysis	8.15	2.16	.83	11.14	10.31	1.75	2.12	2.00
	Up to guarantee.								
	HOMER COTTON OIL & ICE CO., LTD., HOMER, LA.								
	CLAIBORNE MIXTURE. NO. 1.								
	Guarantee	8.00	2.00	1.00	11.00	10.00	1.75	2.12	.50
22	Average of analyses	8.53	3.53	.90	12.96	12.06	2.20	2,67	.74

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	CLAIBORNE MIXTURE. NO. 1.—*Continued.*								
	Maximum	9.50	3.96	.95	13.55	12.60	2.59	3.15	.79
	Minimum	7.55	3.10	.85	12.36	11.51	1.81	2.19	.68
	All up to guarantee.								
	CLAIBORNE MIXTURE, NO. 2.								
	Guarantee	4.00	2.00	1.00	7.00	6.00	3.00	3.64	1.00
10	Average of analyses	7.64	4.33	.70	12.67	11.97	2.60	3.16	.72
	Maximum	8,07	4.47	.80	13.32	12.52	2.71	3.29	.90
	Minimum	7.20	4.06	.61	12.28	11.67	2.47	3.01	.56
	Ten samples below guarantee in nitrogen and potash.								
	JACKSON FERTILIZER CO., JACKSON, MISS.								
	CHICAGO RAW BONE SUPERPHOSPHATE.								
	Guarantee	7.50	2.00	1.00	10.50	9.50	1.65	2.00	1.50
4	Average of analyses	7.70	3.63	4.02	15.06	11.06	1.65	2.00	2.04
	All up to guarantee.								
	FRUIT AND VEGETABLE.								
	Guarantee	3.00	3.00	1.00	7.00	6.00	3.00	3,64	4.00
2	Average of analyses	4.91	1.79	.90	7.60	6.70	2.81	3.41	4.00
	Two samples below guarantee in nitrogen.								
	RED STAR.								
	Guarantee	7.50	2.00			9.50	1.65	2.00	2.25
2	Average of analyses	6.99	2.72	1.06	10.77	9.71	1.67	2.02	2.20
	Two samples below guarantee in potash.								
	ROYAL "C" BRAND.								
	Guarantee	7.50	2.00	1.00	10.50	9.50	1.65	2.00	1.80
25	Average of analyses	7.92	2.78	1.49	12.19	10.70	1.70	2.06	2.18

	Maximum	8.95	3.50	2.40	13.40	11.05	2.25	2.73	2.70
	Minimum	6.50	2.05	1.15	11.06	9.72	1.37	1.66	1.88
	Ten samples below guarantee in nitrogen.								
	Fifteen samples up to or above guarantee.								
	MERIDIAN FERTILIZER FACTORY, MERIDIAN, MISS.								
	BLOOD AND BONE.								
	Guarantee	8.00	1.00	1.00	10.00	9.00	1.65	2.00	1.50
2	Average of analyses	8.00	3.55	2.22	13.77	11.55	1.65	2.00	1.70
	All samples up to guarantee.								
	HOME MIXTURE.								
	Guarantee	8.00	1.00	1.00	10.00	9.00	1.65	2.00	1.50
116	Average of analyses	8.68	2.88	1.09	12.65	11.56	1.73	2.10	1.64
	Maximum	8.95	3.20	1.32	12.95	11.77	1.89	2.29	1.80
	Minimum	8.45	2.47	.75	12.40	11.17	1.65	2.00	1.54
	All samples up to guarantee.								
	MINDEN COTTON OIL & ICE CO., MINDEN, LA.								
	NORTH LOUISIANA STANDARD.								
	Guarantee	8.00	2.00	1.00	11.00	10.00	1.75	2.12	.50
52	Average of analyses	8.22	3.27	1.57	13.06	11.49	2.24	2.72	.62
	Maximum	9.60	4.50	2.00	13.21	12.10	2.78	3.38	.73
	Minimum	7.30	.70	.80	12.30	10.30	1.96	2.37	.50
	All up to guarantee.								
	NEW ORLEANS FERTILIZER AND MANUFACTURING CO., GRETNA, LA.								
	BLOOD, BONE AND BEEF.								
	Guarantee	7.00	2.00	2.00	11.00	9.00	1.65	2.00	1.00
15	Average of analyses	8.50	3.10	1.79	13.39	11.60	1.81	2.19	1.25
	Maximum	9.10	3.38	2.25	13.80	12.48	1.91	2.31	1.33
	Minimum	7.90	2.81	1.32	12.96	10.71	1.70	2.06	1.16
	All up to guarantee.								
	BLOOD, BONE AND POTASH,								
	Guarantee	7.00	2.00	2.00	11.00	9.00	1.65	2.00	1.00

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	BLOOD, BONE AND POTASH.—*Continued.*								
136	Average of analyses	7.79	3.31	2.93	14.03	11.10	1.87	2.27	1.11
	Maximum	8.30	5.23	3.47	17.00	13.53	2.20	2.67	1.26
	Minimum	7.50	1.62	2.32	12.54	9.12	1.46	1.77	1.02
	Eighteen samples belsw guarantee in nitrogen.								
	One hundred and eighteen samples up to or above guarantee.								
	ECONOMIZER.								
	Guarantee	8.00	2.00	2.00	12.00	10.00	1.65	2.00	2.00
2	Average of analyses	4.82	3.69	1.45	9.96	8.51	2.46	2.99	3.11
	Two samples below guarantee in available phosphoric acid.								
	GOLD DUST.								
	Guarantee	7.00	2.00	2.00	11.00	9.00	1.65	2.00	1.00
170	Average of analyses	8.78	3.47	2.81	15.06	12.25	1.48	1.80	1.33
	Maximum	9.58	3.66	3.00	15.80	12.80	1.76	2.13	1.67
	Minimum	8.25	3.22	2.56	14.65	11.78	1.01	1.22	1.09
	Seventy-one samples below guarantee in nitrogen.								
	Ninety-nine samples up to or above guarantee.								
	GOLDSMIT'HS IMPROVED MIXTURE.								
	Guarantee	7.00	2.00	2.00	11.00	9.00	1.65	2.00	1.00
137	Average of analyses	8.02	2.84	3.44	14.30	10.86	1.93	2.34	1.13
	Maximum	8.12	2.86	3.80	14.78	10.98	1.97	2.39	1.55
	Minimum	7.92	2.82	3.08	13.82	10.74	1.88	2.28	.70
	Seventeen samples below guarantee in potash.								
	One hundred and twenty samples up to or above guarantee.								

	PLANTERS FERTILIZER & MANUFACTURING CO., NEW ORLEANS, LA.								
	PLANTERS COTTON AND CORN.								
	Guarantee	6.50	2.50			9.00	1.65	2.00	1.00
55	Average of analyses	6.87	2.69	1.25	10.81	9.56	1.60	1.94	1.93
	Maximum	7.25	2.93	1.62	11.80	10.18	1.69	2.05	2.03
	Minimum	6.25	2.35	.87	9.91	9.04	1.45	1.76	1.86
	Five samples below guarantee in nitrogen.								
	Fifty samples up to or above guarantee.								
	PLANTERS COTTON AND CORN NO. 1.								
	Guarantee	6.50	2.50			9.00	1.65	1.09	1.00
17	Average of analyses	7.10	2.95	1.06	11.11	10.05	1.58	1.92	2.10
	Maximum	7.95	3.10	1.25	12.30	11.05	1.65	2.00	2.16
	Minimum	6.25	2.79	.87	9.91	9.04	1.50	1.82	2.03
	Sixteen samples below guarantee in nitrogen.								
	One sample up to or above guarantee.								
	PLANTERS COTTON AND CORN NO. 2.								
	Guarantee	6.50	2.50			9.00	1.65	2.00	1.00
1	Analysis	6.25	3.31	1.19	10.75	9.56	1.33	1.61	2.00
	Below guarantee in nitrogen.								
	PLANTERS 9—2—1.								
	Guarantee					9.00	1.65	2.00	1.00
8	Average of analyses	6.25	2.79	.87	9.91	9.04	1.65	2.00	2.03
	All samples up to guarantee.								
	PRIVATE FORMULA.								
	Guarantee					7.00	2.47	3.00	6.00
1	Analysis	5.50	3.19	1.19	9.88	8.69	2.65	3.22	6.76
	Up to guarantee.								
	SPECIAL FORMULA.								
	Guarantee (not given)								
2	Average of analyses	8.55	2.28	1.90	12.73	10.83	3.98	4.84	3.31

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	PLANTERS FERTILIZER & MANFG. CO.—*Continued.*								
	STUBBS' COTTON AND CORN.								
	Guarantee					7.00	1.65	2.00	2.00
137	Average of analyses	6.25	2.49	1.23	9.97	8.74	1.67	2.02	2.54
	Maximum	7.30	2.87	1.69	11.05	9.36	1.94	2.35	2.74
	Minimum	5.20	2.06	.87	9.20	8.07	1.49	1.81	2.16
	Twelve samples below guarantee in nitrogen.								
	One hundred and twenty-five samples up to or above guarantee.								
	SUPERPHOSPHATE.								
	Guarantee					9.00	1.65	2.00	1.00
1	Analysis	6.25	3.93	1.00	11.18	10.18	1.81	2.25	1.75
	Up to guarantee.								
	VEGETABLE.								
	Guarantee					7.00	2.47	3.00	3.00
3	Average of analyses	5.45	2.30	1.25	9.00	7.75	2.01	2.44	3.12
	Three samples below guarantee in nitrogen.								
	RUSTON OIL MILL & FERTILIZER CO., RUSTON, LA.								
	COTTON KING.								
	Guarantee	6.00	2.00	1.00	9.00	8.00	1.75	2.12	2.00
37	Average of analyses	815	3.77	.95	12.87	11.92	1.90	2.30	.87
	Maximum	9.35	4.57	1.45	14.63	13.92	2.14	2.60	1.40
	Minimum	7.51	2.95	.68	11.97	10.55	1.63	1.98	.42
	Two samples below guarantee in both nitrogen and potash, and 35 samples below guarantee in potash.								

	SHREVEPORT FERTILIZER CO., SHREVEPORT, LA.								
	CADDO CORN.								
	Guarantee	4.00	2 00	1.00	7.00	6.00	2.88	3.50	1.00
13	Average of analyses	4.25	2.61	.79	7.65	6.86	2.64	3.21	1.20
	Maximum	4.57	2.83	.82	8.22	7.40	2.76	3.35	1.35
	Minimum	3·92	2.38	.75	7.05	6.30	2.52	3.06	1.04
	Thirteen samples below guarantee in nitrogen.								
	CADDO COTTON.								
	Guarantee	6.00	2.00	1.00	9.00	8.00	2.06	2.50	1.00
173	Average of analyses	5.52	2.61	.88	9.01	8.13	2.20	2.67	1.17
	Maximum	6.25	3.12	1.50	9.75	8.71	2 81	3.31	1.41
	Minimum	4.83	1.77	.40	8.01	7.26	1.88	2.28	1.00
	Forty-five samples below guarantee in nitrogen and forty below guarantee in available phosphoric acid.								
	Eighty-eight samples up to or above guarantee.								
	CADDO SPECIAL.								
	Guarantee	4.00	2.00	1.00	7.00	6.00	2.47	3.00	7.00
2	Average of analyses	5 33	1.88	.68	7.89	7.21	2.73	3.32	4.51
	One sample below guarantee in nitrogen and potash, and one below in potash.								
	CADDO VEGETABLE.								
	Guarantee	6.00	2 00	1.00	9.00	8.00	3.30	4.00	4.00
3	Average of analyses	5.27	3.15	.62	9.04	8.42	3.63	4.41	3.40
	Maximum	6.60	3.66	.78	10.16	9.66	4.50	5.47	4.40
	Minimum	4.40	2.73	.50	7.70	7.13	3.06	3.71	1.76
	One sample below guarantee in nitrogen, available phosphoric acid and potash.								
	Two samples up to or above guarantee.								
	CORN AND VEGETABLE.								
	Guarantee	4.00	2.00	1.00	7.00	6.00	2.88	3.50	1.00
54	Average of analyses	4.26	2.55	.71	7.52	6.81	2.73	3.32	1.10
	Maximum	4.95	2.92	.82	8.43	7.87	2.82	3.42	1.35
	Minimum	3.92	2.02	.56	7.05	6.30	2.31	2.80	.63
	Fifty samples below guarantee in nitrogen and four samples below guarantee in nitrogen and potash.								

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	SHREVEPORT FERTILIZER CO.—*Continued.*								
	STAR.								
	Guarantee	8.00	2.00	1.00	11.00	10.00	1.65	2.00	2.00
7	Average of analyses	7.67	2.96	1.02	11.65	10.63	1.90	2.30	1.15
	Maximum	8.43	3.16	1.44	12.50	11.06	2.07	2.52	1.67
	Minimum	6.84	2.63	.78	10.78	10.00	1.68	2.04	.85
	Seven samples below guarantee in potash.								
	STANDARD GUANO & CHEMICAL MANUFACTURING CO., NEW ORLEANS, LA.								
	AMMONIATED RAW BONE SUPERPHOSPHATE.								
	Guarantee	4.00	5.00			9.00	1.65	2.00	1.50
559	Average of analyses	6.60	3.89	2.34	12.83	10.49	1.75	2.12	1.85
	Maximum	6.85	4.46	4.77	14.95	11.31	1.88	2.28	2.36
	Minimum	6.40	3.20	.86	11.30	10.00	1.52	1.84	1.28
	Two hundred and forty-six samples below guarantee in nitrogen and potash.								
	Two hundred and thirteen samples up to or above guarantee.								
	BLOOD, BONE AND MEAT.								
	Guarantee	4.00	4.74			8.74	1.70	2.06	2.00
49	Average of analyses	6.78	3.70	2.53	13.01	10.48	1.88	2.28	2.17
	Maximum	6.98	3.98	3.36	13.63	10.93	2.44	2.97	2.64
	Minimum	6.40	3.22	1.52	12.40	9.62	1.45	1.76	1.67
	Twenty-three samples below guarantee in nitrogen and potash.								
	Twenty-six samples up to or above guarantee.								

	CABBAGE.								
	Guarantee	4.00	5.00			9.00	3.00	3.64	5.00
11	Average of analyses	6.26	3.21	1.47	10.94	9.47	3.19	3.87	5.74
	Maximum	6.56	3.56	1.50	11.03	9.53	3.25	3.94	5.91
	Minimum	5.97	2.86	1.43	10.85	9.42	3.12	3.78	5.56
	All samples up to guarantee.								
	CHAMPION FARMERS CHOICE.								
	Guarantee	4.00	4.00			8.00	1.65	2.00	1.50
224	Average of analyses	6.60	3.73	1.70	12.03	10.33	1.84	2.23	2.14
	Maximum	7.20	4.27	3.25	13.90	11.04	2.10	2.55	2.70
	Minimum	5.90	3.31	.91	10.12	9.21	1.65	2.00	1.68
	All samples up to guarantee.								
	GARIG & WILSON RAW BONE SUPERPHOSPHATE.								
	Guarantee					9.00	1.65	2.00	1.00
1	Analysis	7.68	2.82	1.60	12.10	10.50	1.47	1.79	1.76
	Below guarantee in nitrogen.								
	HIGH GRADE SUGAR.								
	Guarantee	7.00	3.00	1.00	11.00	10.00	2.50	3.04	2.00
29	Average of analyses	9.71	3.01	1.99	14.71	12.72	2.78	3.38	2.47
	Maximum	10.39	3.94	4.40	17.34	13.17	3.08	3.74	2.90
	Minimum	9.00	2.59	.77	13.37	12.26	2.40	2.92	1.41
	Twenty-four samples below guarantee in nitrogen and potash. Five samples up to or above guarantee.								
	MISSISSIPPI HOME GUANO.								
	Guarantee	4.00	5.00			9.00	1.65	2.00	2.00
52	Average of analyses	7.97	3.98	1.76	13.71	11.95	1.67	2.02	2.62
	Maximum	8.55	4.78	1.79	13.92	12.13	1.73	2.10	3.10
	Minimum	6.93	3.58	1.73	13.44	11.71	1.54	1.87	2.34
	Twenty-four samples below guarantee in nitrogen. Twenty-eight samples up to or above guarantee.								
	MISSISSIPPI HOME GUANO.								
	Guarantee	7.00	2.00			9.00	1.65	2.00	1.00
6	Average of analyses	7.01	3.74	5.13	15.88	10.75	1.23	1.47	1.06
	Six samples below guarantee in nitrogen.								

Number of Samples	Name of Manufacturer and Brand	Phosphoric Acid. Water Soluble	Phosphoric Acid. Reverted	Phosphoric Acid. Insoluble	Phosphoric Acid. Total	Phosphoric Acid. Available	Nitrogen	Ammonia	Potash
	STANDARD GUANO & CHEMICAL MFG. CO.—*Continued.*								
	McCALL'S FORMULA.								
	Guarantee	3.75	1.25	......	......	5.00	3.85	4.67	1.00
20	Average of analyses	4.72	2.72	1.69	9.13	7.44	4.15	5.04	1.42
	Maximum	4.96	2.77	2.75	10.48	7.73	4.63	5.63	1.83
	Minimum	4.48	2.67	.63	7.78	7.15	3.69	4.48	1.01
	Fifteen samples below guarantee in nitrogen.								
	Five samples up to or above guarantee.								
	ORANGE TREE.								
	Guarantee (not given)	......	......	......	......	......	......	......	......
1	Analysis	......	......	......	21.90	......	3.15	3.75	3.16
	STANDARD AMMONIATED SOLUBLE GUANO.								
	Guarantee	4.00	4.00	......	......	8.00	1.65	2.00	1.50
4	Average of analyses	6.40	4.34	3.15	13.89	10.74	1.69	2.05	1.58
	All samples up to guarantee.								
	VEGETABLE.								
	Guarantee	4.00	2.00	......	......	6.00	3.00	3.64	5.00
26	Average of analyses	6.12	3.33	1.53	10.98	9.45	3.00	3.64	5.12
	Maximum	6.63	3.51	1.60	11.67	10.14	3.63	4.41	5.73
	Minimum	5.72	3.21	1.46	10.60	9.00	2.37	2.88	3.90
	Four samples below guarantee in nitrogen and phosphoric acid.								
	Twenty-two samples up to or above guarantee								

	SWIFT & CO., EAST ST. LOUIS, ILL., AND NATIONAL STOCK YARDS, ILL.								
	COMPLETE FERTILIZER.								
	Guarantee					8.00	4.12	5.00	2.00
9	Average of analyses	6.06	4.05	1.90	11.57	9.67	4.51	5.48	2.02
	All samples up to guarantee.								
	MIXED FERTILIZER.								
	Guarantee					10.00	2.47	3.00	2.00
1	Analysis	8.60	3.73	1.89	14.22	12.33	2.94	3.57	2.53
	Up to guarantee.								
	SWIFT FERTILIZER WORKS, ATLANTA, GA.								
	COTTON PLANT.								
	Guarantee	6.00	2.00	1.00	9.00	8.00	1.65	2.00	1.00
7	Average of analyses	6.61	3.95	1.91	12.47	10.56	2.00	2.43	1.41
	All samples up to guarantee.								
	GOLDEN HARVEST.								
	Guarantee	5.00	2.00	1.00	8.00	7.00	1.65	2.00	2.00
2	Average of analyses	4.05	3.86	1.48	9.39	7.91	2.55	3.10	2.58
	All samples up to guarantee.								
	TENNESSEE CHEMICAL CO., NASHVILLE, TENN.								
	OX SLAUGHTER HOUSE BONE.								
	Guarantee	6.00	2.00	1.00	9.00	8.00	1.65	2.00	2.00
1	Analysis	4.85	4.04	4.16	13.05	8.89	1.65	2.00	2.26
	Up to guarantee.								
	VIRGINIA-CAROLINA CHEMICAL CO., MEMPHIS, TENN.								
	HIGH GRADE GUANO.								
	Guarantee	8.00	2.00	2.00	12.00	10.00	1.65	2.00	1.50
1	Analysis	2.27	7.86	2.87	13.00	10.13	1.65	2.00	1.42
	Below guarantee in potash.								

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID					Nitrogen	Ammonia	Potash
		Water Sol-uble	Reverted	Insoluble	Total	Available			
	VIRGINIA-CAROLINA CHEMICAL CO.—*Continued.*								
	MOBILE DOUBLE EAGLE.								
	Guarantee					10.00	1.65	2.00	1.50
1	Analysis	7.92	4.91	.46	13.29	12.83	2.07	2.52	1.38
	Up to guarantee.								
	MOBILE DOUBLE STANDARD.								
	Guarantee					10.00	1.65	2.00	1.50
3	Average of analyses	7.80	3.95	2.05	13.80	11.75	1.66	2.01	1.37
	Three samples below guarantee in potash.								
	ROYAL AMMONIATED BONE.								
	Guarantee					9.00	1.65	2.00	1.00
3	Average of analyses	6.05	3.84	1.88	11.77	9.89	1.91	2.31	1.11
	All samples up to guarantee.								
	ROYAL ANIMAL BONE.								
	Guarantee	7.00	2.00	2.00	11.00	9.00	1.65	2.00	1.00
2	Average of analyses	5.97	4.14	2.39	12.50	10.11	1.40	1.70	1.23
	Two samples below guarantee in nitrogen.								
	ROYAL BLOOD AND BONE.								
	Guarantee					9.00	1.65	2.00	1.00
3	Average of analyses	7.81	2.77	3.19	13.77	10.58	1.42	1.72	1.07
	Three samples below guarantee in nitrogen.								
	ROYAL BLOOD, BONE AND POTASH.								
	Guarantee					9.00	1.65	2.00	1.00

1	Analysis	7.20	1.80	1.20	10.20	9.00	1.59	1.93	1.13
	Below guarantee in nitrogen.								
	ROYAL COTTON BOLL.								
	Guarantee	6.00	2.00	2.00	10.00	8.00	1.65	2.00	2.00
15	Average of analyses	4.68	4.64	1.81	11.13	9.32	1.84	2.23	2.25
	Maximum	5.47	7.06	2.69	12.64	10.89	2.12	2.57	2.59
	Minimum	3.83	3.38	1.31	9.76	8.16	1.61	1.95	1.83
	Four samples below guarantee in nitrogen and potash.								
	Eleven samples up to or above guarantee.								
	ROYAL FRUIT GROWER.								
	Guarantee	6.00	2.00	2.00	10.00	8.00	2.47	3.00	5.00
1	Analysis	3.53	2.22	.67	6.42	5.75	3.37	4.09	6.05
	Below guarantee in available phosphoric acid.								
	ROYAL HIGH GRADE GUANO.								
	Guarantee	8.00	2.00	2.00	12.00	10.00	1.65	2.00	1.50
10	Average of analyses	8.03	4.03	1.56	13.62	12.06	1.56	1.89	1.44
	Maximum	9.20	4.65	2.70	16.55	13.85	2.12	2.57	1.96
	Minimum	7.45	3.30	.50	12.16	10.80	1.01	1.22	1.04
	Two samples below guarantee in nitrogen and potash.								
	Eight samples up to or above guarantee.								
	ROYAL VEGETABLE GROWER.								
	Guarantee	6.00	2.00	2.00	10.00	8.00	2.47	3.00	4.00
2	Average of analyses	6.78	3.39	1.81	11.98	10.17	2.15	2.61	3.24
	One sample below guarantee in nitrogen and potash and one sample below guarantee in potash.								
	SCOTT'S GOSSYPIUM PHOSPHO.								
	Guarantee	8.00	2.00	2.00	12.00	10.00	1.65	2.00	1.50
63	Average of analyses	7.09	3.76	1.20	12.05	10.85	1.85	2.24	1.66
	Maximum	7.70	4.47	2.00	12.55	11.61	2.02	2.45	1.80
	Minimum	6.00	3.07	.91	11.72	10.20	1.70	2.06	1.57
	All samples up to guarantee.								

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID.					Nitrogen	Ammonia	Potash
		Water Soluble	Reverted	Insoluble	Total	Available			
	VIRGINIA-CAROLINA CHEMICAL CO.—*Continued.*								
	SCOTT'S MEAL FORMULA.								
	Guarantee					9.00	1.65	2.00	1.00
1	Analysis	8.20	2.28	3.02	13.50	10.48	1.71	2.07	1.87
	Up to guarantee.								
	SCOTT'S STATE STANDARD								
	Guarantee	6.00	2.00	2.00	10.00	8.00	1.65	2.00	2.00
6	Average of analyses	7.14	2.87	1.14	11.15	10.11	1.62	1.97	2.04
	Three samples below guarantee in nitrogen.								
	Three samples up to or above guarantee.								

ACID PHOSPHATES.

Acid phosphates or superphosphates contain only one fertilizing constituent of value, viz.: phosphoric acid, but this ingredient is almost invariably present in three forms. Fertilizers of this class are made by treatment of bone ash, bone black, natural phosphates, coprolites, etc., with sulphuric acid. The phosphoric acid in these instances is combined with lime in the proportion of one part of phosphoric acid to three of lime. In this combination it is soluble only in acids. By treatment of the rock with sulphuric acid two parts of the lime are removed, leaving one part of phosphoric acid in combination with one part of lime, and in this form the phosphoric acid is readily soluble in water, and hence usually styled "soluble phosphoric acid." There is also formed simultaneously two parts of sulphate of lime (gypsum), which necessarily constitutes about one-half the weight of every acid phosphate made by this process. In England, where sulphuric acid is cheap, and where only the soluble form of phosphoric acid is recognized, acid phosphates yield upon analysis almost entirely soluble phosphoric acid. In this country, where sulphuric acid is dearer, and the reverted gives equal value with the soluble, acid phosphates contain all three forms of phosphoric acid. The change is brought about in the following manner: At the time of manufacture an amount of sulphuric acid insufficient to render soluble all of the phosphoric acid present is used, thus leaving in the mass some insoluble phosphates. This mass, containing both soluble and insoluble phosphates, is permitted to remain in bulk, and in the course of time a reaction takes place, which results in the formation of reverted phosphates. This reaction may be explained as follows: The phosphoric acid with one part of lime acts upon the phosphoric acid with three parts of lime, forming two molecules of phosphoric acid with two parts of lime. Therefore nearly every American acid phosphate contains all three forms of phosphoric acid. There are high grade acid phosphates on the market which are made by the action of phosphoric acid upon bone, ash and rock phosphates.

The following were analyzed:

Number of Samples.	Name of Manufacturer and Brand.	PHOSPHORIC ACID.				
		Water Soluble	Reverted	Insoluble	Total	Available
	HAZLEHURST OIL MILL & FERTILIZER CO., HAZLEHURST. MISS.					
	ACID PHOSPHATE.					
	Guarantee	10.00	2.00	1.50	13.50	12.00
1	Analysis	11.80	4.68	1.72	18.20	16.48
	Up to guarantee.					
	JACKSON FERTILIZER CO., JACKSON, MISS.					
	ACID PHOSPHATE.					
	Guarantee					14.00
6	Average of analyses	13.15	3.41	1.65	18.21	16.56
	All samples up to guarantee.					
	HIGH GRADE ACID PHOSPHATE.					
	Guarantee					12.00
1	Analysis	10.80	4.91	1.14	16.85	15.71
	Up to guarantee.					
	MERIDIAN FERTILIZER FACTORY, MERIDIAN, MISS.					
	SOUTHERN ACID PHOSPHATE.					
	Guarantee	12.00	2.00	1.00	15.00	14.00
21	Average of analyses.	12.25	3.63	.98	16.86	15.88
	Maximum	12.58	4.40	2.54	18.60	16.70
	Minimum	11.80	2.94	.30	15.04	14.74
	All samples up to guarantee.					

	MINDEN COTTON OIL & ICE CO., MINDEN, LA.					
	HIGH GRADE ACID PHOSPHATE.					
	Guarantee					12.00
9	Average of analyses	13.41	3.98	.59	17.98	17.39
	All samples up to guarantee.					
	NEW ORLEANS ACID & FERTILIZER CO., GRETNA, LA.					
	BLACK DIAMOND ACID PHOSPHATE.					
	Guarantee	10.00	2.00	2.00	14.00	12.00
98	Average of analyses	10.16	5.56	1.54	17.26	15.72
	Maximum	10.50	6.40	2.39	17.55	16.00
	Minimum	9.45	4.56	.65	16.65	15.06
	All samples up to guarantee.					
	CRESCENT CITY ACID PHOSPHATE.					
	Guarantee	10.00	2.00	2.00	14.00	12.00
47	Average of analyses	12.27	3.39	2.87	18.53	15.66
	Maximum	12.38	3.80	3.02	18.90	16.18
	Minimum	12.15	2.98	2.72	18.15	15.13
	All samples up to guarantee.					
	PLANTERS FERTILIZER & MANUFACTURING CO., NEW ORLEANS, LA.					
	ACID PHOSPHATE.					
	Guarantee					1 .00
18	Average of analyses	11.45	3.51	2.39	17.35	14.96
	All samples up to guarantee.					
	ACID PHOSPHATE.					
	Guarantee					16.00
1	Analysis	12.10	4.48	2.15	18.73	16.58
	Up to guarantee.					
	ENGLISH ACID PHOSPHATE.					
	Guarantee					13.00
2	Average of analyses	14.80	3.19	2.16	20.15	17.99
	Up to guarantee.					

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID. Water Soluble	PHOSPHORIC ACID. Reverted	PHOSPHORIC ACID. Insoluble	PHOSPHORIC ACID. Total	PHOSPHORIC ACID. Available
	STANDARD GUANO & CHEMICAL MANUFACTURING CO., NEW ORLEANS, LA.					
	ACID PHOSPHATE.					
	Guarantee	10.00	2.00			12.00
160	Average of analyses	13.66	5.14	1.66	20.46	18.80
	Maximum	15.85	6.48	2.72	21.60	20.10
	Minimum	12.20	4.08	1.10	19.78	17.46
	All samples up to guarantee.					
	SHREVEPORT FERTILIZER CO., SHREVEPORT, LA.					
	ACID PHOSPHATE.					
	Guarantee					14.00
1	Analysis	13.10	2.99	1.48	18.07	16.59
	Up to guarantee.					
	ACID PHOSPHATE.					
	Guarantee					16.00
9	Average of analyses	13.12	4.25	1.94	19.31	17.37
	One sample below guarantee.					
	Eight samples up to or above guarantee.					
	VIRGINIA-CAROLINA CHEMICAL CO., MEMPHIS, TENN.					
	ACID PHOSPHATE.					
	Guarantee (not given)					
1	Analysis	13.75	3.66	1.24	18.65	17.41

	I. X. L. ACID PHOSPHATE.					
	Guarantee					14.00
1	Analysis	11.40	2.80	1.05	15.25	14 20
	Up to guarantee.					
	ROYAL ACID PHOSPHATE.					
	Guarantee					14.00
8	Average of analyses	11.30	4.09	2.71	18.10	15.39
	One sample below guarantee.					
	Seven samples up to or above guarantee.					
	ROYAL BONE SUPERPHOSPHATE.					
	Guarantee					15.00
2	Average of analyses	12.00	4.93	.97	17.90	16.93
	All samples up to guarantee.					
	SCOTT'S HIGH GRADE ACID PHOSPHATE.					
	Guarantee					14.00
20	Average of analyses	12.70	4.25	1.61	18.56	16.95
	Maximum	15.70	4.52	2.52	22.67	20.15
	Minimum	9.80	3.78	.62	16.00	14.32
	All samples up to guarantee.					
	V.-C. SUPERPHOSPHATE.					
	Guarantee					16.00
1	Analysis	14.00	2.93	1.62	18.55	16.93
	Up to guarantee.					
	V.-C. SUPERPHOSPHATE AND KAINIT.					
	Guarantee					12.00
1	Analysis	12.90	6.00	1.00	19.90	18.90
	Up to guarantee; no potash present nor guaranteed.					

FERTILIZERS CONTAINING PHOSPHORIC ACID AND POTASH.

The past season a few fertilizers containing only available phosphoric acid and potash were sold in the State. The following were analyzed:

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID.					Potash
		Water Sol-uble	Reverted	Insoluble	Total	Available	
	PLANTERS FERTILIZER & MANUFACTURING CO., NEW ORLEANS, LA.						
	RICE FERTIILIZER.						
	Guarantee					10.00	3.00
2	Average of analyses	8.78	2.57	.78	12.13	10.35	2.57
	Two samples below guarantee in potash.						
	NEW ORLEANS ACID AND FERTILIZER CO., GRETNA, LA.						
	DISSOLVED BONE AND POTASH.						
	Guarantee	8.00	2.00	2,00	12,00	10,00	2.00
39	Average of analyses	9.80	3.53	2.87	16,20	13.33	3.32
	All samples up to guarantee.						
	STANDARD GUANO & CHEMICAL MANUFACTURING CO., NEW ORLEANS, LA.						
	ACID PHOSPHATE AND KAINIT.						
	Guarantee (not given).						
1	Analysis	8.40	4.56	1.63	14,59	12.96	2.60
	DISSOLVED BONE AND POTASH.						
	Guarantee (not given)						
1	Analysis	7.31	3.71	1.68	12.70	11.02	4.00

Number of Samples	Name of Manufacturer and Brand	PHOSPHORIC ACID.					Potash
		Water Soluble	Reverted	Insoluble	Total	Available	
	SWIFT FERTILIZER WORKS, ATLANTA, GA.						
	FARMERS HOME.						
	Guarantee	8.00	2.00	1.00	11.00	10.00	4.00
1	Analysis	6.51	5.81	.82	13.14	12.32	4.50
	Up to guarantee.						
	FIELD AND FARM.						
	Guarantee	7.00	2.00	1.00	10.00	9.00	2.00
1	Analysis	5.09	5.06	1.66	11.81	10.15	2.31
	Up to guarantee.						
	VIRGINIA-CAROLINA CHEMICAL CO., MEMPHIS, TENN.						
	CAPITAL BONE AND POTASH COMPOUND.						
	Guarantee	....	....	....	....	10.00	2.00
3	Average of analyses	2.80	7.80	1.70	12.30	10.60	1.86
	Three samples below guarantee in potash.						
	C. B. O. COMPOUND.						
	Guarantee	....	....	....	....	10.00	2.00
1	Analysis	9.05	3.56	.51	13.12	12.61	2.71
	Up to guarantee.						
	ROYAL COMPOUND.						
	Guarantee	....	....	....	....	10.00	2.00

10	Average of analyses	7.87	3.73	2.65	14.25	11.60	2.05
	All samples up to guarantee.						
	ROYAL GRAIN GROWER.						
	Guarantee					10.00	4.00
1	Analysis	8.42	2.90	1.82	13.14	11.32	4.00
	Up to guarantee.						

COTTON SEED MEAL.

This, to the Southern farmer, is the cheapest and most easily obtainable form of nitrogen. Although it has acquired an extensive use as a fertilizer throughout the whole State, it has been exempted from the operations of the fertilizer law by virtue of its employment as a feeding stuff.*

On account of the presence of quite appreciable quantities of hulls in many samples of meal found upon the market, it is very essential that great care should be observed in the purchase of this article. Hulls can easily be detected by the non-homogeneous appearance of the emal containing them, and also by passing a small quantity of the meal through an ordinary sifter.

The best undamaged meal has a bright yellow color and is dry and pulverulent.

The damaged meal is invariably darker in color, and though rendered unfit for use as a feed stuff, does not lose any of its value for fertilizing purposes.

Frequent requests are made for the comparative values of cotton seed meal, cotton seed and cotton seed hulls. To furnish a basis for comparison, the analyses of average samples of cotton seed, cotton seed meal, and cotton seed hulls, are here given and their valuation per ton by the tariff of prices given on page ——.

ANALYSES.

	Nitrogen.	Phosphoric Acid.	Potash.	Value Per Ton.
Cotton seed	3.007	1.3	1.2	$12.12
Cotton seed meal.......	7.007	3.0	2.0	27.42
Cotton seed hulls.......	.707	.25	1.0	3.37

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* Note—By amending act published elsewhere in this Bulletin cotton seed meal sold for fertilizing purposes is now subject to provisions of the fertilizer law.

These are values for fertilizing purposes only and have no reference to feeding value.

The average analysis of ashes of cotton seed hulls will show 9.17 phosphoric acid and 23.47 potash. With these comparative values a farmer can decide from prevailing prices of seed, meal and hulls whether it is expedient to sell his seed and buy meal and hulls or to use them as fertilizer.

The following analyses of cotton seed meals were made:

Number of Samples	Name of Manufacturer and Brand	Nitrogen	Ammonia
	ARCADIA COTTON OIL MILL & MANUFACTURING CO., ARCADIA, LA.		
	Guarantee	7.50	9.11
7	Average of analyses	7.59	9.22
	All samples up to guarantee.		
	ARKANSAS COTTON OIL CO., PINE BLUFF, ARK.		
	Guarantee	6.59	8.00
8	Average of analyses	7.11	8.63
	All samples up to guarantee.		
	ARKANSAS COTTON OIL CO., LITTLE ROCK, ARK.		
	Guarantee	6.59	8.00
1	Analysis	6.59	8.00
	BREAUX BRIDGE OIL WORKS, BREAUX BRIDGE, LA.		
	Guarantee	6.55	7.95
28	Average of analyses	7.38	8.96
	Maximum	7.56	9.18
	Minimum	6.98	8.47
	All samples up to guarantee.		
	CLINTON OIL & MANUFACTURING CO., CLINTON, LA.		
	Guarantee	6.59	8.00
1	Analysis	6.85	8.32
	Up to guarantee.		
	CAPITAL CITY OIL MILL CO., BATON ROUGE, LA.		
	Guarantee	6.00	7.29
18	Average of analyses	6.92	8.40
	Maximum	6.95	8.44
	Minimum	6.89	8.37
	All samples up to guarantee.		
	DALLAS COTTON OIL CO., DALLAS, TEX.		
	Guarantee	6.00	7.29
2	Average of analyses	6.78	8.24
	All samples up to guarantee.		
	FARMERS COTTON OIL CO., CLEBURNE, TEX.		
	Guarantee	6.59	8.00
1	Analysis	8.07	9.80
	Up to guarantee.		

Number of Samples	Name of Manufacturer and Brand	Nitrogen	Ammonia
	FELICIANA OIL MILL, ST. FRANCISVILLE, LA.		
	Guarantee	6.00	7.29
3	Average of analyses	7.04	8.55
	All samples up to guarantee.		
	GRAND ECORE COTTON OIL CO., NATCHITOCHES, LA.		
	Guarantee	6.00	7.29
2	Average of analyses	6.73	8.18
	All samples up to guarantee.		
	HAZLEHURST OIL MILL & FERTILIZER CO., HAZLEHURST, MISS.		
	Guarantee	6.59	8.00
1	Analysis	7.26	8.81
	Up to guarantee.		
	HOMER COTTON OIL CO., HOMER, LA.		
	Guarantee	6.00	7.29
31	Average of analyses	7.24	8.79
	Maximum	7.38	8.96
	Minimum	7.14	8.67
	All samples up to guarantee.		
	JACKSON FERTILIZER CO., JACKSON, MISS.		
	Guarantee	6.25	7.59
1	Analysis	7.04	8.55
	Up to guarantee.		
	MINDEN COTTON OIL & ICE CO., MINDEN, LA.		
	Guarantee	7.00	8.50
32	Average of analyses	7.34	8.91
	Maximum	7.67	9.32
	Minimum	6.83	8.30
	One sample below guarantee. Thirty-one samples up to or above guarantee.		
	MISSISSIPPI COTTON OIL CO., NATCHEZ, MISS.		
	Guarantee	6.59	8.00
22	Average of analyses	6.77	8.23
	Maximum	7.04	8.55
	Minimum	6.59	8.00
	All samples up to guarantee.		
	MISSISSIPPI COTTON OIL CO., GREENVILLE, MISS.		
	Guarantee	6.59	8.00
1	Analysis	6.49	7.89
	Below guarantee.		

Number of Samples	Name of Manufacturer and Brand	Nitrogen	Ammonia
	NEW IBERIA MILLING & DEVELOPMENT CO., LTD., NEW IBERIA, LA.		
	Guarantee	6.00	7.29
39	Average of analyses	7.51	9.12
	Maximum	7.67	9.32
	Minimum	7.35	8.93
	All samples up to guarantee.		
	Guarantee	5.00	6.07
1	Analysis	5.67	6.89
	Up to guarantee.		
	NEW ORLEANS ACID & FERTILIZER CO., GRETNA, LA.		
	Guarantee	6.00	7.29
1	Analysis	6.72	8.16
	Up to guarantee.		
	NEW ORLEANS COTTON SEED OIL & MANUFACTURING CO., LTD., NEW ORLEANS, LA.		
	Guarantee	6.59	8.00
9	Average of analyses	6.43	7.82
	Seven samples below guarantee. Two samples up to or above guarantee.		
	PEOPLE'S COTTON OIL CO., LAFAYETTE, LA.		
	Guarantee	7.40	8.98
21	Average of analyses	7 60	9.23
	Maximum	7.78	9.45
	Minimum	7.50	9.10
	All samples up to guarantee.		
	PLANTERS OIL MILL, MONROE, LA.		
	Guarantee	6.59	8.00
55	Average of analyses	7.31	8.87
	Maximum	7.56	9.18
	Minimum	7.00	8.50
	All samples up to guarantee.		
	RACCOURCI COTTON OIL CO., BATCHELOR, LA.		
	Guarantee	6.59	8.00
2	Average of analyses	6.39	7.76
	Two samples below guarantee.		
	RED RIVER OIL CO., ALEXANDRIA, LA.		
	Guarante	6.17	7.50
21	Average of analyses	6.80	8.65

Number of Samples	Name of Manufacturer and Brand	Nitrogen	Ammonia
	RED RIVER OIL CO., ALEXANDRIA.—*Continued*		
	Maximum	6.66	8.09
	Minimum	5.66	6.87
	One sample below guarantee.		
	Twenty samples up to or above guarantee		
	Guarantee	6.59	8.00
33	Average of analyses	6.44	7.83
	Maximum	7.48	9.08
	Minimum	5.83	7.08
	Twenty-eight samples below guarantee.		
	Five samples up to or above guarantee.		
	RUSTON OIL MILLS, RUSTON, LA.		
	Guarantee	7.00	8.50
6	Average of analyses	7.19	8.83
	Four samples below guarantee.		
	Two samples up to or above guarantee.		
	SHREVEPORT FERTILIZER CO., SHREVEPORT, LA.		
	Guarantee	4.75	5.77
19	Average of analyses	4.99	6.06
	Maximum	7.00	8.50
	Minimum	4.27	5.19
	Seventeen samples below guarantee.		
	Two samples up to or above guarantee.		
	SONIA COTTON OIL CO., ALEXANDRIA, LA.		
	Guarantee	6.59	8.00
56	Average of analyses	6.40	7.78
	Maximum	6.51	7.90
	Minimum	6.31	7.66
	Fifty-six samples below guarantee.		
	ST. LANDRY COTTON OIL CO., OPELOUSAS, LA.		
	Guarantee	6.59	8.00
104	Average of analyses	7.40	8.99
	Maximum	7.52	9.13
	Minimum	7.10	8.62
	All samples up to guarantee.		
	ST. MARTIN OIL WORKS, ST. MARTINSVILLE, LA.		
	Guarantee	6.59	8.00
27	Average of analyses	6.93	8.41
	Maximum	7.12	8.64
	Minimum	6.71	8.15
	All samples up to guarantee.		

Number of Samples	Name of Manufacturer and Brand	Nitrogen	Ammonia
	SOUTHERN OIL & FERTILIZER CO., MERIDIAN, MISS.		
	Guarantee	4.94	6.00
84	Average of analysis	6.95	8.46
	Maximum	7.00	8.50
	Minimum	6.90	8.38
	All samples up to guarantee.		
	TENSAS COTTON OIL CO., ST. JOSEPH, LA.		
	Guarantee	6.00	7.29
4	Average of analyses	6.44	8.83
	All samples up to guarantee.		
	WASHINGTON COTTON OIL MILL CO., WASHINGTON, LA.		
	Guarantee	6.59	8.00
44	Average of analyses	7.24	8.79
	Maximum	7.56	9.18
	Minimum	7.04	8.55
	All samples up to guarantee.		
	UNION OIL CO., BUNKIE, LA.		
	Guarantee	6.18	7.51
37	Average of analyses	6.57	7.99
	Maximum	6.68	8.12
	Minimum	6.33	7.69
	All samples up to guarantee.		
	Guarantee	6.59	8.00
38	Average of analyses	6.53	7.94
	Maximum	6.75	8.20
	Minimum	6.34	7.70
	Eleven samples below guarantee.		
	Twenty-seven samples up to or above guarantee.		
	UNION OIL CO., GRETNA, LA.		
	Guarantee	6.59	8.00
4	Average of analyses	6.59	8.00
	All samples up to guarantee.		
	UNION OIL CO., SHREVEPORT, LA.		
	Guarantee	6.59	8.00
18	Average of analyses	6.74	8.19
	Maximum	7.16	8.69
	Minimum	6.54	7.95
	Five samples below guarantee.		
	Thirteen samples up to or above guarantee.		

Number of Samples	Name of Manufacturer and Brand	Nitrogen	Ammonia
	UNION OIL CO., TORRAS, LA.		
	Guarantee	6.59	8.00
8	Average of analyses	6.35	7.71
	Eight samples below guarantee.		
	UNION OIL CO., VIDALIA, LA.		
	Guarantee	6.59	8.00
11	Average of analyses	7.31	8.87
	Maximum	7.51	9.12
	Minimum	7.20	8.74
	All samples up to guarantee.		
	UNION OIL CO., WEST MONROE, LA.		
	Guarantee	6.59	8.00
23	Average of analyses	6.83	8.34
	Maximum	6.86	8.33
	Minimum	6.78	8.24
	All samples up to guarantee.		

TANKAGE.

The fertilizer has grown rapidly in favor since its introduction into this State, and is each year becoming more largely in demand. It consists chiefly of waste products from slaughter houses, and is a mixture of partly cooked bone and meat, deposited in tanks in which the refuse from the butcher is treated to separate the grease. It ordinarily contains good percentages of both nitrogen and phosphoric acid, the proportions of each, in general, varying almost inversely as the quantity of the other. The relative proportions of nitrogen and phosphoric acid having such wide limits of variation, this class of goods, of course, exhibits a corresponding wide range in value for fertilizing uses. When a considerable excess of bone is present, the proportion of phosphoric acid is largely above that of the nitrogen, while with an excess of meat, the contents of nitrogen becomes large and that of phosphoric acid becomes comparatively small. In the latter case, the action of both ingredients has been found to be more satisfactory. The phosphoric acid in the tankage, being derived principally from bone, is chiefly the insoluble form and its value is largely dependent upon the degree of fineness of division of the particles, a well pulverized sample responding more readily to the needs of the plant. Purchasers of fertilizers of this class should always buy upon a guarantee of definite percentages of nitrogen and phosphoric acid, as their varying composition renders almost indispensible a knowledge of the proportions of their constituents. The bone present should also be in a very finely divided condition.

Since tankage is valuable chiefly for the nitrogen or ammonia, care should be taken in buying this fertilizer to secure the highest percentage of this ingredient. Guarantees of 9 per cent ammonia and 20 per cent bone phosphate (which is about equivalent to 9 per cent phosphoric acid) can be secured from any edaler in this class of fertilizers, and no lower content of nitrogen should be bought from an economical standpoint, since the freight from the Western packing houses to the consumer is the same per ton on all kinds, and the higher the content the cheaper the nitrogen per pound to the consumer when the cost of freight is added.

The following samples were analyzed:

Number of Samples	Name of Manufacturer and Brand	Phosphoric Acid	Nitrogen	Ammonia
	ARMOUR FERTILIZER WORKS, CHICAGO, ILL., ETC.			
	PLANTERS BEST.			
	Guarantee		9.87	12.00
5	Average of analyses	4.59	10.02	12.17
	One sample below guarantee.			
	Four samples up to or above guarantee.			
	CRESCENT CITY STOCK YARDS & SLAUGHTER HOUSE CO., NEW ORLEANS, LA.			
	CRESCENT FINISHED FERTILIZER.			
	Guarantee		5.88	7.14
5	Average of analyses	9.05	7.19	8.73
	All samples up to guarantee.			
	SWIFT & CO., LTD., CHICAGO., ILL., ETC.			
	TANKAGE.			
	Guarantee	4.58	5.76	7.00
21	Average of analyses	6.48	6.35	7.70
	Maximum	9.00	9.09	11.04
	Minimum	4.00	5.17	6.28
	Four samples below guarantee in nitrogen and one sample below in phosphoric acid.			
	Sixteen samples up to or above guarantee.			
	Guarantee	11.45	5.76	7.00
4	Average of analyses	11.15	6.74	8.19
	One sample below guarantee in nitrogen and one below in phosphoric acid.			
	Two samples up to or above guarantee.			
	Guarantee	4.58	6.59	8.00
104	Average of analyses	8.78	6.82	8.28
	Maximum	18.75	8.75	10.42
	Minimum	4.63	5.15	6.25
	Twenty-two samples below guarantee in nitrogen.			
	Eighty-two samples up to or above guarantee.			

Number of Samples	Name of Manufacturer and Brand	Phosphoric Acid	Nitrogen	Ammonia
	SWIFT & CO., LTD.—*Continued.*			
	Guarantee	9.16	6.59	8.00
8	Average of analyses	10.71	6.79	8.25
	All samples up to guarantee.			
	Guarantee	4.58	7.41	9.00
66	Average of analyses	10.03	7.05	8.56
	Maximum	16.27	8.24	10.00
	Minimum	4.60	5.89	7.15
	Forty-six samples below guarantee in nitrogen.			
	Twenty samples up to or above guarantee.			
	Guarantee	6.87	7.41	9.00
8	Average of analyses	12.16	7,24	8.79
	Six samples below guarantee in nitrogen.			
	Two samples up to or above guarantee.			
	Guarantee	4.58	8,24	10.00
42	Average of analyses	7.20	8,12	9.86
	Maximum	14.70	9.16	11.12
	Minimum	5 35	7.41	9.00
	Twenty-one samples below guarantee in nitrogen.			
	Twenty-one samples up to or above guarantee.			
	Guarantee	6.87	8,24	10.00
8	Average of analyses	6.64	8.33	10.11
	One sample below guarantee in nitrogen and phosphoric acid, one below in nitrogen and four below in phosphoric acid.			
	Two samples up to or above guarantee.			
	Guarantee	4.58	8.65	10.50
18	Average of analyses	5.75	8.74	10.61
	Maximum	6.97	9.41	11.43
	Minimum	4.20	8.20	9.95
	Four samples below guarantee in nitrogen and one below in phosphoric acid.			
	Fourteen samples up to or above guarantee.			
	Guarantee	4.58	9.06	11.00
5	Average of analyses	7.05	8.74	10.61
	Four samples below guarantee in nitrogen.			
	One sample up to guarantee.			
	Guarantee	3.20	9.88	12.00
23	Average of analyses	5.10	9.44	11.47
	Maximum	6.43	10.59	12.86
	Minimum	4.40	8,91	10.57
	Twenty-two samples below guarantee in nitrogen.			
	One sample up to guarantee.			

BONE MEAL.

Bones pulverized to a greater or less degree of fineness are sold as "Bone Meal," "Bone Dust," "Ground Bone," etc., and are extensively used in some countries for fertilizing purposes. They have, as yet, acquired but little favor in the South, and but few brands were on the market this season. As their utility depends largely upon the state of division of their particles, both a mechanical and chemical examination are necessary in determining their value.

In addition to the phosphoric acid found in bone black and bone oil, ground bone contains a good part of nitrogen derived from the gelatinous matter present in the raw substance.

The following were analyzed:

Number of Samples	Name of Manufacturer and Brand	Phosphoric Acid	Nitrogen	Ammonia
	CRESCENT CITY STOCK YARDS & SLAUGHTER HOUSE CO., NEW ORLEANS, LA.			
	GROUND BONE.			
	Guarantee	24.31	3.92	4.75
4	Average of analyses	23.62	4.07	4.95
	One sample below guarantee in phosphoric acid.			
	Three samples up to or above guarantee.			
	JACKSON FERTILIZER CO., JACKSON, MISS.			
	BONE MEAL.			
	Guarantee	22.93	2.50	3.04
3	Average of analyses	26.20	3.34	4.05
	All samples up to guarantee.			
	NEW ORLEANS ACID & FERTILIZER CO., GRETNA, LA.			
	BONE MEAL			
	Guarantee	20.00	2.06	2.50
5	Average of analyses	24.40	3.94	4.78
	All samples up to guarantee.			

Number of Samples	Name of Manufacturer and Brand	Phosphoric Acid	Nitrogen	Ammonia
	NEW ORLEANS ACID & FERTILIZER CO., GRETNA, LA.—*Continued.*			
	Guarantee	18.00	2.06	2.50
6	Average of analyses	24.20	3.90	4.73
	All samples up to guarantee			
	STANDARD GUANO & CHEMICAL MANUFACTURING CO., NEW ORLEANS, LA.			
	FINE GROUND BONE.			
	Guarantee	18.50	2.50	3.04
4	Average of analyses	20.71	3.65	4.63
	All samples up to guarantee.			
	PURE RAW GROUND BONE.			
	Guarantee	18.50	2.50	3.06
261	Average of analyses	19.22	3.15	3.82
	Maximum	19.80	3.87	4.70
	Minimum	17.87	2.60	3.16
	Thirteen samples below guarantee in phosphoric acid.			
	One hundred and eighty-eight samples up to or above guarantee.			
	SWIFT & CO., LTD., CHICAGO, ILL., ETC.			
	BONE MEAL.			
	Guarantee	25.00	2.47	3.00
15	Average of analyses	27.54	2.54	3.09
	Maximum	27.80	2.77	3.37
	Minimum	26.70	2.47	3.00
	All samples up to guarantee.			
	GROUND STEAMED BONE.			
	Guarantee	25.19	2.47	3.00
1	Analysis	29.07	2.38	2.90
	Below guarantee in nitrogen.			

MISCELLANEOUS FERTILIZERS.

Under this head are included the analyses of fertilizing materials not given in preceding tables. The following were analyzed:

Number of Samples	Name of Manufacturer and Brand	Phosphoric Acid	Nitrogen	Ammonia	Potash
	NITRATE OF SODA.				
	JACKSON FERTILIZER CO., JACKSON, MISS.				
	Guarantee	....	15.00	18.21	....
1	Analysis	....	16.00	19.43	....
	Up to guarantee.				
	NEW ORLEANS ACID & FERTILIZER CO., GRETNA, LA.				
	Guarantee	....	13.18	16.00	....
2	Average of analyses	....	15.84	19.23	....
	All samples up to guarantee.				
	STANDARD GUANO & CHEMICAL MANUFACTURING CO., NEW ORLEANS, LA.				
	Guarantee (not given)	....	....	....	....
10	Average of analyses	....	16.05	19.49	....
	KAINIT.				
	ACKSON FERTILIZER CO., JACKSON, MISS.				
	Guarantee	....	....	....	12.00
2	Average of analyses	....	....	....	12.63
	All samples up to guarantee.				
	MERIDIAN FERTILIZER FACTORY, MERIDIAN, MISS.				
	Guarantee	....	....	....	12.00
1	Analysis	....	....	....	12.21
	Up to guarantee.				
	NEW ORLEANS ACID & FERTILIZER CO., GRETNA, LA.				
	Guarantee (not given)	....	....	....	....
2	Average of analyses	....	....	....	12.45
	SHREVEPORT FERTILIZER CO., SHREVEPORT, LA.				
	Guarantee	....	....	....	12.00

Number of Samples	Name of Manufacturer and Brand	Phosphoric Acid	Nitrogen	Ammonia	Potash
	SHREVEPORT FERTILIZER CO.—*Continued.*				
2	Average of analyses				12.22
	All samples up to guarantee.				
	STANDARD GUANO & CHEMICAL MANUFACTURING CO., NEW ORLEANS, LA.				
	Guarantee (not given)				
32	Average of analyses				12.71
	Maximum				13.30
	Minimum				12.32
	VIRGINIA-CAROLINA CHEMICAL CO., MEMPHIS, TENN.				
	Guarantee				12.00
2	Average of analyses				11.84
	One sample below guarantee.				
	One sample up to guarantee.				
	MURIATE OF POTASH.				
	JACKSON FERTILIZER CO., JACKSON, MISS.				
	Guarantee				50.00
1	Analysis				52.00
	Up to guarantee.				
	NEW ORLEANS ACID & FERTILIZER CO., GRETNA, LA.				
	Guarantee				50.00
2	Average of analysis				51.94
	All samples up to guarantee.				
	SHREVEPORT FERTILIZER CO., SHREVEPORT, LA.				
	Guarantee				50.00
1	Analysis				50.08
	Up to guarantee.				
	STANDARD GUANO & CHEMICAL MANUFACTURING CO., NEW ORLEANS, LA.				
	Guarantee (not given)				
9	Average of analyses				50.91
	SULPHATE OF POTASH.				
	NEW ORLEANS ACID & FERTILIZER CO., GRETNA, LA.				
	Guarantee				50.00
2	Average of analyses				44.00
	Two samples below guarantee.				

Number of Samples	Name of Manufacturer and Brand	Phosphoric Acid	Nitrogen	Ammonia	Potash
	SULPHATE OF POTASH.—*Continued.*				
	STANDARD GUANO & CHEMICAL MANUFACTURING CO., NEW ORLEANS, LA.				
	Guarantee (not given)				
4	Average of analyses				49.08
	FRUIT TREE.				
	Guarantee (not given)				
2	Average of analyses	20.77	2.95	3.58	3.29
	BARATARIA FISH SCRAP.				
	BARATARIA CANNING CO., BILOXI, MISS.				
	Guarantee	4.00	6.80	8.25	
1	Analysis	4.77	6.91	8.39	
	Up to guarantee.				

PARIS GREEN

is largely used in this State as an insecticide, chiefly for the destruction of the cotton caterpillar, whose ravages are frequently so injurious. This chemical consists chiefly of the "Arsenite of Copper," with a small proportion of the Acetate of Copper, and a first-class article should contain not less than 50 per cent of arsenious acid, known in its pure state as white arsenic.

This article is frequently adulterated, and there are abundant opportunities for fraud in its purchase. Farmers and planters frequently complain of the ineffectiveness of Paris Green after use on their cotton; but they failed to take samples in accordance with the above law, and therefore have no means of definitely determining whether fraud has been practiced.

Many farmers and planters in Central Louisiana have made report of the ineffectiveness of the Paris Green used on their cotton during the present season. This is reported after a failure, but they failed to take samples in accordance with the above law, and therefore had no means of ascertaining positively whether fraud had been perpetrated.

The law fully protects every farmer if he will observe it. Before buying, inspect packages and see that "Strictly Pure" and "Guaranteed," with the fac-simile of the signature of the Commissioner of Agriculture and Immigration are stamped on each. If they are, take a sample in accordance with directions of the law, and if after using little or no benefit accrues, have it analyzed by the official chemist, and, if deficient, damages can be recovered. The following samples have been analyzed:

Number of Samples	Name of Manufacturer or Seller	Arsenious Acid
	I. L. LYONS & CO., NEW ORLEANS.	
	Guarantee	50.00
354	Average of analyses	56.54
	All samples up to guarantee.	
	FINLAY, DICK & CO., NEW ORLEANS.	
23	Average of analyses	56.99
	All samples up to guarantee.	
	PARKER, BLAKE & CO., NEW ORLEANS.	
1	Analysis	56.93

ANNUAL

FERTILIZER REPORT

FOR THE

SEASON, 1903-1904.

Comprising a Report of Tonnage, and
Comparison of Same.

BY

CHAS. H. O'ROURKE,

Chief Inspector.

NEW ORLEANS, January 20, 1905.

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LETTER OF TRANSMITTAL.

Commissioner J. G. Lee, of the Louisiana State Board of Agriculture and Immigration, Baton Rouge, La.

SIR—In the affairs of commerce, as in all things else, the uses and customs prevailing after long years of existence sometimes become inconsistent and antiquated as to the customs and necessities of a people. The need of Legislative ruling existed some years prior to the year 1888 for the enactment of a fertilizer law, but like the evolution of human affairs, it necessitated time to develop a condition propitious to a proper fulfillment of a people's need, and since the passage of the first law (Act 51 of 1888) customs and change of conditions effecting a difference in requirements, has been the cause of re-enacting the original law no less than three different times (Acts 51 of 1888, 72 of 1894 and 126 of 1898), while appended to the scope of the present fertilizer law might be included Act 48 of 1902 that applies to cotton seed meal when sold as fertilizer; Act 153 of 1904 that applies to commercial feed, and Act 174 of 1904 that applies to Paris green. This report in its entirety is a resume of the work performed in the inspection of fertilizers and the analyses of the same. It contains over one hundred pages of typewritten matter, valuable in its import to the record of work and to the Department, but unfortunately too voluminous in its extent to allow of its being printed for public information; therefore the following pages are presented.

Respectfully submitted,

CHAS. H. O'ROURKE,
Chief State Inspector.

Main Office Inspection Department, 714 Union Street, New Orleans, January 18, 1905.

ANNUAL REPORT.

Hon. J. G. Lee, Commissioner of Agriculture and Immigration,
Baton Rouge, La.:

SIR—In submitting this, my Annual Report for the Season 1903-1904, beg to hand you herewith letters received from Inspectors Calhoun, Murphy and Perkins of Calhoun, Terrebonne and Baton Rouge Districts, respectively. These letters were requested during the latter part of last season—though up to the present time have not received a reply from Inspector Sellers, who represented the Department in Leesville District.

The Fertilizer Season of 1903-1904, terminating August 31, 1904, was the most prosperous in the fertilizer trade Louisiana has ever experienced—according to the available records of this Department and statements made by veteran fertilizer manufacturers; the unequaled record being established not only in the tonnage shipped, but also in the crop yields resulting as a consequence.

During the Season 1903-1904, 5,070 reports were made to you by this Department, covering 81,091.56 tons and 1,435,755 sacks of commercial fertilizer.

This is an increase for the Season 1903-1904 over tonnage for Season 1902-1903 amounting to 1,009 inspections, 13,168.96 tons and 224,590 sacks.

The total business in Louisiana for the entire season, *i. e.*, from September 1, 1903, to August 31, 1904, showing results as stated for this period of time.

This tonnage was handled by the different districts as follows: Total inspections made and non-inspections covered by reports of Inspectors Perkins, Calhoun, Sellers, Murphy and O'Rourke respectively, for districts named below, showing number tons of fertilizers shipped to below mentioned districts irrespective of classification:

District—	Reports.	Tons.	Sacks.
Baton Rouge	225	7,617.44	123,551
Calhoun	348	7,519.85	151,198
Leesville	250	3,356.20	66,244
Terrebonne	207	7,548.10	106,972
New Orleans	3,306	37,117.72	675,921
Total	4,336	63,159.31	1,123,886

Sub-Inspectors:			
Baton Rouge	324	6,639.95	132,799
Calhoun	295	7,673.20	107,688
Terrebonne	115	3,619.10	71,382
Total	734	17,932.25	311,869
Grand Total:			
Reported by Inspectors	4,336	63,159.31	1,435,886
Reported by Sub-Inspectors	734	17,932.25	311,869
	5,070	81,091.56	1,435,755

BRAND CLASSIFICATION.

To establish a comprehensive idea as to the classification of this tonnage, and to make plain the extent of the business for the year, the commercial fertilizer shipments have been separated into seven (7) classes and with proper tonnage allotment are as follows:

	Reports.	Tons.	Sacks.
Class One—			
Cotton seed meal fertilizer	1,109	21,336.50	424,403
Class Two—			
Complete fertilizer	2,736	38,847.47	717,444
Class Three—			
Bone Meal	274	2,435.25	24,712
Class Four—			
Acid Phosphate	399	3,477.55	66,972
Class Five—			
Tankage	385	13,611.89	175,807
Class Six—			
Miscellaneous, Kainits, Muriate Potash, Etc.	99	330.30	6,016
Class Seven—			
Acid Phosphate and Potash	68	1,052.60	20,401
Total	5,070	81,091.56	1,435,755

This is the first year that the fertilizer tonnage has been divided into seven (7) classes and the means of allotting the different brands to their proper class has been obtained in the following official chemist's report of former years, which for the Season 1904-1905, it will be necessary to classify the different brands, allotting each to its proper class and the different guarantees registered by manufacturers will be the means of designating each brand.

COMPLETE FERTILIZERS.

The manufacture and sale of complete fertilizers in Louisiana during the past season has been most phenominal and surpassed in proportions, finally reached the brightest expectations entertained at the commencement of the year. Next year this class of goods will be divided into five (5) different classes, as above explained. But as tonnage up to this year includes in the term "Complete Fertilizers," "Bone Meal," "Acid Phosphate," "Miscellaneous" and "Acid Phosphate and Potash," it will be necessary to make calculations correct, to make tonnage comparisons this season including their different classes under head of "Complete Fertilizer."

The business for the Season 1902-1903 in this class of commerce amounted to: Shipments, 3,576; tons, 46,143.17; sacks, 835,545.

Formerly it has been my custom to only report three (3) classes, *i. e.,* Cotton seed meal, complete, and tankage fertilizers.

This year it has been deemed expedient and necessary to establish this new departure into classes. However, the above mentioned terms will apply in future to Classes One, Two and Five.

COTTON SEED MEAL FERTILIZER TONNAGE.

The cotton seed meal fertilizer business for the entire State during the past season amounted to: Shipments, 1,109; tons, 21,336.50; sacks, 424,403.

This is a decrease of 876.60 tons compared with last season's business (892 shipments, 22,213.10 tons and 44,844 sacks).

This tonnage has been handled by the different Inspection Districts as shown below and the following Parishes receiving amounts mentioned:

CLASS ONE—11 PARISHES.

Parish—	Inspections.	Tons.	Sacks.
Assumption	58	1,403.55	28,071
Claiborne	43	634.25	12,685
Iberville	57	1,562.00	31,775
Lafourche	92	3,394.65	67,893
Orleans	217	1,453.85	27,942

Ouachita	30	1,253.85	24,677
St. James	64	1,920.95	37,919
St. John the Baptist	32	554.95	11,099
St. Mary	93	3,039.00	60,180
Terrebonne	79	1,835.10	36,752
West Baton Rouge	19	526.00	10,520
Al other Parishes	325	3,778.35	74,890
	1,109	21,336.50	424,403

Allotted to the different districts, the work done in the direct Inspection and Sub-Inspection Departments, show the following results:

Reported by Sub-Inspection Departments—

	Shipments.	Tons.	Sacks.
Baton Rouge District	324	6,639.95	132,799
Calhoun District	155	4,768.00	94,364
Terrebonne District	115	3,619.10	71,382
	594	15,027.05	298,545

Inspections by Inspectors—

M. S. Perkins	21	635.50	12,710
N. E. Calhoun	14	243.80	4,876
E. T. Sellers	4	24.00	480
J. C. Murphy	34	1,478.00	29,760
Chas. H. O'Rourke	152	1,314.70	26,003
	225	3,696.00	73,829

Non-inspection reports by Inspectors—

M. S. Perkins	38	1,125.35	22,507
E. T. Sellers	1	4.00	80
J. C. Murphy	5	155.00	3,100
Chas. H. O'Rourke	246	1,329.10	26,342
	290	2,613.45	52,029
Total number of shipments, tons and sacks, cotton seed emal fertilizer shipped to Louisiana points	1,109	21,336.50	424,403

To more fully present the extent of the tonnage in complete fertilizers marketed during the past season, the following tabulations that show the number of shipments, tons and sacks, made to each Parish is presented; goods classified in Classes Two, Three, Four, Six and Seven (Class Five being "Tankage," shown under separate head). Items only show amounts of 500 tons or more:

CLASS TWO—18 PARISHES.

Parish—	Inspections.	Tons.	Sacks.
Bienville	152	2,217.95	44,429
Calcasieu	125	1,799.60	35,239
Claiborne	166	2,537.10	52,155
DeSoto	60	833.00	16,640
East Baton Rouge	82	1,576.50	30,785
East Feliciana	259	4,879.00	94,950
Grant	34	511.15	10,169
Jackson	39	1,026.55	20,531
Lincoln	111	2,539.35	25,560
Ouachita	197	2,374.30	47,326
Rapides	49	754.65	15,083
St. Mary	27	682.40	13,634
St. Tammany	242	1,749.15	14,558
Tangipahoa	325	4,469.00	93,547
Union	81	1,438.00	28,680
Washington	245	3,333.75	50,122
Webster	64	1,087.05	22,744
Winn	44	674.30	12,986
All other Parishes	445	4,837.95	93,665
	2,736	38,847.47	717,444

CLASS THREE—2 PARISHES.

Parish—	Inspections.	Tons.	Sacks.
East Feliciana	50	778.60	7,916
St. Tammany	82	636.60	5,707
All other Parishes	142	1,020.05	11,089
	274	2,435.25	24,712

CLASS FOUR—1 PARISH.

Parish—	Inspections.	Tons.	Sacks.
East Feliciana	62	807.50	14,595
All other Parishes	337	2,670.05	52,377
	399	3,477.55	66,972

There were 99 shipments—330.30 tons, 6,016 sacks—Class Six (Miscellaneous fertilizers, such as muriate of potash, Kainit, etc.) shipped to points in Louisiana.

CLASS SEVEN—1 PARISH.

Parish—	Inspections.	Tons.	Sacks.
Calcasieu	58	1,004.00	19,455
Al other Parishes	10	48.60	946
	68	1,052.60	20,401

This tonnage has been handled by the different Inspection and Sub-Inspection Districts as follows; and your attention is called to the fact that the Sub-Inspection Department of Calhoun District handled over 3,000 tons of complete fertilizers in the routine of their work:

	Inspections.	Tons.	Sacks.
By Sub-Inspection Departments of Baton Rouge, Calhoun and Terrebonne	140	3,005.20	13,724
By Inspectors—			
M. S. Perkins	65	1,881.80	36,279
N. E. Calhoun	305	6,873.05	136,247
E. T. Eellers	230	2,978.20	58,884
J. C. Murphy	13	286.00	4,820
Chas. H. O'Rourke	2,443	26,917.17	504,256
	3,056	38,936.22	740,486
Non-inspections by Inspectors—			
N. E. Calhoun	29	403.00	10,075
E. T. Sellers	15	350.00	6,800
J. C. Murphy	3	50.00	1,000
Chas. H. O'Rourke	331	3,498.75	63,840
	378	4,301.75	81,715
	140	3,005.20	13,724
	3,056	38,936.22	740,486
	378	4,301.75	81,715
Grand total, showing number shipments, tons and sacks, complete fertilizers shipped to Louisiana as follows	3,574	46,243.17	834,925

TANKAGE—CLASS FIVE.

The fertilizer business in Louisiana for the Season 1903-1904 amounted to: Shipments, 385; tons, 13,611.89; sacks, This record shows a slight decrease of 867.01 tons and 16,985 sacks, but an increase in number of shipments, amounting to 61, as compared with Season 1902-1903. This tonnage has been handled by the different Districts of the Inspection Department as follows:

INSPECTIONS.

		Tons.	Sacks.
M. S. Perkins, Baton Rouge District	85	3,582.00	48,420
J. C. Murphy, Terrebonne District	150	5,529.10	67,693
Charles H. O'Rourke, New Orleans District	100	2,761.00	38,274
	335	11,872.10	154,387

NON-INSPECTIONS.

M. S. Perkins, Baton Rouge District	14	392.79	3,615
J. C. Murphy, Terrebonne District	2	50.00	599
Charles H. O'Rourke, New Orleans District	34	1,297.00	17,306
	50	1,739.79	21,420
Grand total	385	13,611.89	175,807

As a matter of information and to show the allottment of tonnage where shipments to different Parishes have been made aggregating 500 tons or more, the following tabulations are presented:

CLASS FIVE—9 PARISHES.

Parish—	Inspections.	Tons.	Sacks.
Ascension	35	1,352.00	22,006
Assumption	53	2,163.50	28,191
Iberville	15	549.75	6,275
Lafourche	34	1,068.00	12,915
Plaquemines	19	845.00	10,507
St. Charles	20	535.00	6,657
St. James	44	1,150.29	16,837
St. Mary	40	1,209.12	20,201
Terrebonne	98	3,634.95	45,063
All other Parishes	28	840.12	10,071
	385	13,611.89	175,807

RECAPITULATION SHOWING AMOUNT OF TONNAGE SHIPPED TO LOUISIANA CLASSIFIED AND ALLOTTED TO EACH STATE FROM WHICH SHIPPED.

STATES.	Cotton Seed Meal.			Commercial.			Tankage.		
	Inspections.	Tons.	Sacks.	Inspections.	Tons.	Sacks.	Inspections.	Tons.	Sacks.
Arkansas	18	642.00	12,840						
Mississippi	165	887.85	17,760	385	7,278.15	144,780			
Tennessee				206	3,947 55	76,046			
Georgia				34	618.00	10,240			
Illinois				23	408.00	5,930	78	2,720.95	31,400
Texas	3	65.00	1,300				30	1,053.00	12,544
Louisiana	885	18,616.30	369,990	3065	56 126.82	620,382	3	60.15	800
Missouri							25	1,112.79	12,260
Nebraska							56	1,937.00	28,922
Minnesota							78	2,448.00	32,342
Kansas							116	4,170.00	56,219
Totals	1071	30,211.15	403,890	3613	68,378.52	857,378	386	13,501.89	174,487

REGISTRATIONS OF COMMERCIAL FERTILIZER BRANDS BY MANUFACTURERS

Brand.	Name of Dealer or Manufacturer.	Domicile of Dealer or Manufacturer.
Bone Meal	The Armour Fert. Works	Chicago and Omaha.
Armour's Cane Grower	The Armour Fert. Works	Chicago, Ill. Omaha, Neb. Kansas City, Mo. Fort Worth, Tex. Nashville, Tenn Atlanta, Ga. East St. Louis, Ill
Plantation Special		
Planters' Best	The Armour Fert. Works	East St. Louis, Ill
Louisiana Special	The Armour Fert. Works	East St. Louis, Ill
Corn and Cotton	The Armour Fert. Works	East St. Louis, Ill
King Cotton	The Armour Fert. Works	East St. Louis, Ill
All Soluble	The Armour Fert. Works	East St. Louis, Ill
A. C. O. Co.'s Acid Phosphate	Arcadia Cotton Oil Mill and Mfg. Co.	Arcadia, La.
A. C. O. Co.'s Cotton Fertilizer	Arcadia Cotton Oil Mill and Mfg. Co	Arcadia, La.
A. C. O. Co.'s Corn Fertilizer	Arcadia Cotton Oil Mill and Mfg. Co	Arcadia, La.
A. C, O. Co.'s Poor Land Fertilizer	Arcadia Cotton Oil Mill and Mfg. Co	Arcadia, La.
Barataria Shrimp Scrap	Barataria Canning Co.	Biloxi, Miss.
Birmingham H. G. A. Phosphate and Ammonia	Birmingham Fertilizer Co	Birmingham, Ala.
Birmingham Std. G. Fertilizer	Birmingham Fertilizer Co	Birmingham, Ala.
Nonpareil	Capital Fertilizer Mfg. Co	Jackson, Miss.
Red Star Brand	Capital Fertilizer Mfg. Co	Jackson, Miss.
Cotton Elevator	Capital Fertilizer Mfg. Co	Jackson, Miss.
H. G. Acid Phosphate	Capital Fertilizer Mfg. Co	Jackson, Miss.
German Kainit	Capital Fertilizer Mfg. Co	Jackson, Miss.
Crescent Finished Fertilizer	The Crescent City Stock Yard and Slaughter House Co., Ltd.	New Orleans, La.
Crescent Ground Bone	The Crescent City Stock Yard and Slaughter House Co., Ltd	New Orleans, La.
Blood and Bone Fertilizer	The Cudahy Packing Co	South Omaha, Neb. Kansas City, Kan. Sioux City, Ia.
C. O. M. C. O. Fertilizer	Clinton Oil and Mfg. Co., Ltd	Clinton, La.
Imperial	Hazlehurst O. M. & Fert. Co	Hazlehurst, Miss.
Superior	Hazlehurst O. M. & Fert. Co	Hazlehurst, Miss.
Diamond A.	Hazlehurst O. M. & Fert. Co	Hazlehurst, Miss.
High Grade	Hazlehurst O. M. & Fert. Co	Hazleharst, Miss.
Acid Phosphate	Hazlehurst O. M. & Fert. Co	Hazlehurst, Miss.
German Kainit	Hazlehurst O. M. & Fert. Co	Hazlehurst, Miss.
High Grade Ac. Phosphate	Jackson Fertilizer Co	Jackson, La.

AND DEALERS, FOR THE SEASON 1903-04 IN COMPLIANCE WITH ACT 126 OF 1898.

Weight of Package.	Nitrogen.	PHOSPHORIC ACID.			Potash.	Ammonia.
		Soluble	Reverted	Insoluble		
100-167	2.47	......	10.00-14.00	14.00-16.00	......	......
200						
100	3.29	6.00	2.00 to 3.00	2.00 to 3.00	......	......
150						
167						
200						
100	7.00	......	4.00	2.50	......	......
150						
167						
200						
......	9.87	......	......	......	......	......
......	6.58	......	......	......	......	......
100	.82	6.00	2.00	2.00	1.00	......
167	1.65	6.00	2.00	2.00	2.00	......
200	2.88	6.00	2.00	2.00	4.00	......
100	......	14.00	......	......	......	......
100	1.75 to 2.00	10.50	......	......	.50 to 1.00	......
100	3.50 to 4.00	7.00	......	......	1.00	......
100	5.50 to 6.00	4.00	......	......	1.50	......
100	6.80	......	......	4.00	......	......
200	1.65	11.00	3.00	2.00	......	......
200	1.65	6.00	2.00	2.00	2.00	......
100	1.65	7.50	2.00	1.00	2.25	......
100	1.65	7.50	2.00	1.00	2.25	......
100	1.65	7.50	2.00	1.00	2.25	......
100	......	10.00	2.00	1.00	......	......
100	......	......	......	......	12.00	......
150	5.88	......	......	......	......	7.14
200	3.92	Total 24.31	......	......	......	......
100	5.50	5.40	......	8.00	......	......
200	......	......	......	......	......	......
......	......	......	......	......	......	......
100	1.75	6.00	4.36	.84	2.00	......
100	1.65	7.00	2.00	1.00	1.50	......
100	1.65	7.00	2.00	1.00	1.50	......
100	2.00	5.00	1.50	1.00	3.00	......
......	......	12.00	2.00	1.00	......	......
100	......	......	......	......	12.00	......
100	6.00	2.00	......	......	......	8.00
100	......	10.00	2.00	1.00	......	......

Brand.	Name of Dealer or Manufacturer.	Domicile of Dealer or Manufacturer.
Chicago R. B. Superphos..	Jackson Fertilizer Co	Jackson, Miss
Lampton's R. B. Superphosphate	Jackson Fertilizer Co	Jackson, Miss
Gulf States' Guano	Jackson Fertilizer Co	Jackson, Miss
Royal C. Brand	Jackson Fertilizer Co	Jackson, Miss
Fruit and Vegetable	Jackson Fertilizer Co	Jackson, Miss
Black Hawk Acid Phosphate	Jackson Fertilizer Co	Jackson, Miss
German Kainit.	Jackson Fertilizer Co	Jackson, Miss
High Grade Ac. Phosphate	Jackson Fertilizer Co	Jackson, Miss
Black Hawk Acid Phosphate	Jackson Fertilizer Co	Jackson, Miss
Bone Meal	Jackson Fertilizer Co	Jackson, Miss
Pure Steamed Bone.	B. M. Morrison. Swift & Co., Ltd	Hammond, La. Chicago, Ill
Pure Raw Bone Meal.	B. M. Morrison Swift & Co., Ltd	Hammond, La. Chicago, Ill
Meridian Home Mixture	Meridian Fert. Factory	Meridian. Miss
Meridian Soluble Guano	Meridian Fert. Factory	Meridian, Miss
Meridian Blood and Bone..	Meridian Fert. Factory	Meridian, Miss
Meridian Veget'ble Grow'r	Meridian Fert. Factory	Meridian, Miss
Meridian Southern Acid Phosphate.	Meridian Fert. Factory	Meridian, Miss
Planters' Cotton and Corn 1	Planters' Fert. Mfg. Co.	New Orleans
Planters' Cotton and Corn 2.	Planters' Fert. Mfg. Co.	New Orleans
Stubbs' Formula Cotton and Corn	Planters' Fert. Mfg. Co.	New Orleans
Planters' Cotton and Corn Maker	Planters' Fert. Mfg. Co.	New Orleans
Planters' High Grade Superphosphate.	Planters' Fert. Mfg. Co.	New Orleans
Stubbs' Formula for Vegetables	Planters' Fert. Mfg. Co.	New Orleans
Planters' Acid Phosphate..	Planters' Fert. Mfg. Co.	New Orleans
Planters' Rice and Oat Fertilizer	Planters' Fert. Mfg. Co.	New Orleans
Kainit (German)	Planters' Fert. Mfg. Co.	New Orleans
Muriate of Potash	Planters' Fert. Mfg. Co.	New Orleans
Henry McCall's Formula Sugar Cane	Planters' Fert. Mfg. Co.	New Orleans
Stubbs' Formula for Sugar Cane	Planters' Fert. Mfg. Co.	New Orleans
Maginnis' Formula Sugar Cane	Planters' Fert. Mfg. Co.	New Orleans
Planters' Special Strawberry Fert.	Planrers' Fert. Mfg. Co.	New Orleans
Planters' Special Ammoniated Rice Fert.	Planters' Fert. Mfg. Co.	New Orleans

Weight of Package.	Nitrogen.	PHOSPHORIC ACID.			Potash.	Ammonia.
		Soluble	Reverted	Insoluble		
100	1.65	7.50	2.00	1.00	1.50	......
200	1.65	7.50	2,00	1.00	1.50	......
100	1.65	7.50	2.00	1.00	1.80	......
100	1.65	7.50	2.00	1.00	1.80	......
100	3.00	3.00	3.00	1.00	4.00	......
100	......	10.00	2.00	1.00	......	......
200	......	......	......	......	12.00	......
100	......	12.00	2 00	1.00	......	......
100	......	12.00	2.00	1.00	......	......
......	2.50	......	......	......	B. P. Lime 50 p. c.	
200	......	Total Phosphoric Acid 25 per ct.			......	3.00
200	3.00	Total Phosphoric Acid 23 per ct.			......	......
100	1.65	8.00	1.00	1.00	1.50	......
100	1.65	8.00	1.00	1.00	1.50	......
100	1.65	8.00	1.00	1.00	1.50	......
100	2.50	5.00	1.00	6.00	6.00	......
100	......	12.00	2.00	14.00	......	......
100	1.65	6.50	2.50	2.00	1.00	......
100	1.65	6.50	2.50	2.00	1.00	......
100	1.65	5.00	2.00	1.50	2.00	......
100	1.65	7.15	2.85	2.00	2.00	......
100	1.65	7.15	2.85	2.00	2.00	......
100	2.47	5.00	2.00	1.50	3.50	......
100	......	13.00	2.00	1.00	......	......
100	......	7.15	2.85	1.50	2.00	......
100	......	......	......	......	12.00	......
100	......	......	......	......	48.00	......
100	3.71	3.60	1.40	1.50	.50 or trace	
100	2.27	5.40	2.10	1.50	2.00	......
100	3.30	7.15	2.85	1.50	Trace	......
100	1.65	3.60	1.40	1.00	5.00	......
100	.82	5.00	2.00	1.00	2.00	......

Brand.	Name of Dealer or Manufacturer.	Domicile of Dealer or Manufacturer.
Planters' Young Fruit Tree Fert.	Planters' Fert. Mfg. Co.	New Orleans
Planters' Fruit Tree Fert.	Planters' Fert. Mfg. Co.	New Orleans
Planters' Special Cabbage Fertilizer	Planters' Fert. Mfg. Co.	New Orleans
Planters' Special Tomato Fertilizer	Planters' Fert. Mfg. Co.	New Orleans
Planters' English Acid Phosphate.	Planters' Fert. Mfg. Co.	New Orleans
Stanley & Gore's Raw Bone Superphosphate.	Planters' Fert. Mfg. Co.	New Orleans
Gilead Phosphate	E. D. Reichert & Co. Jones Bros. Chemical Co.	Roseland, La. Cincinnati, O.
Cotton King.	Ruston Oil Mills & Fert. Co., Ltd.	Ruston, La.
Daybreak Fertilizer	Rumble & Wensel Co. Federal Chemical Co	Natchez, Miss Nashville, Tenn
Daybreak P. H. S. Acid Phosphate	Rumble & Wensel Co, Federal Chemical Co	Natchez, Miss Nashville, Tenn
Raw Bone Superphosphate	St'drd G. & Chem. Mfg. Co.	New Orleans
Champion	St'drd G. & Chem. Mfg. Co.	New Orleans
Ground Bone	St'drd G. & Chem. Mfg. Co.	New Orleans
Acid Phosphate	St'drd G. & Chem. Mfg. Co.	New Orleans
Standard Sugar Cane	St'drd G. & Chem. Mfg. Co.	New Orleans
Kainit (imported).	St'drd G. & Chem. Mfg. Co.	New Orleans
Stern's Diss. Bone	St'drd G. & Chem. Mfg. Co.	New Orleans
Miss. Home Guano	St'drd G. & Chem. Mfg. Co.	New Orleans
Blood, Bone & Meat	St'drd G. & Chem. Mfg. Co.	New Orleans
McCall's Formula	St'drd G. & Chem. Mfg. Co.	New Orleans
Pelican Raw Bone Guano.	St'drd G. & Chem. Mfg. Co.	New Orleans
Vegetable	St drd G. & Chem. Mfg. Co.	New Orleans
Peguin.	St'drd G. & Chem. Mfg. Co.	New Orleans
Standard Am. Sol. Guano.	St'drd G. & Chem. Mfg. Co.	New Orleans
Fruit Tree Fert	St'drd G. & Chem. Mfg. Co.	New Orleans
Sulphate of Potash (imp'd)	St'drd G. & Chem. Mfg. Co.	New Orleans
Muriate of Potash	St'drd G. & Chem. Mfg. Co.	New Orleans
Standard R. B. Rice Fert.	St'drd G. & Chem. Mfg. Co.	New Orleans
Diss. Bone & Potash.	St'drd G. & Chem. Mfg. Co.	New Orleans
Acid Phos. & Potash	St'drd G. & Chem. Mfg. Co.	New Orleans
Nitrate of Soda (imported)	St'drd G. & Chem. Mfg. Co.	New Orleans
Special formulas as ordered—		
Champion	St'drd G. & Chem. Mfg. Co.	New Orleans
Miss. Home Guano	St'drd G. & Chem. Mfg. Co.	New Orleans
Star.	Shreveport Fert. Co	Shreveport, La.
Crown	Shreveport Fert. Co	Shreveport, La.
Caddo Cotton.	Shreveport Fert. Co	Shreveport, La
Corn & Vegetable	Shreveport Fert. Co	Shreveport, La
Caddo Vegetable	Shreveport Fert. Co	Shreveport, La
Caddo Special	Shreveport Fert. Co	Shreveport, La
Acid Phosphate	Shreveport Fert. Co	Shreveport, La

Weight of Package.	Nitrogen.	PHOSPHORIC ACID.			Potash.	Ammonia.
		Soluble	Reverted	Insoluble		
100	3.30	2.80	1.20	1.50	1.00	....
100	1.65	4.00	2.00	1.00	5.00	....
100	2.48	4.00	2.00	1.00	4.00	....
100	1.65	3.60	1.40	1.00	3.00	....
100	....	10.76	2.15	2.85	....	....
100	1.65	9.00	2.00	....	6.00	....
100	2.47	9.00	10.00	....	2.00	....
....	....	....	....	....	....	....
100	1.75	6.00 to 8.00	2.00 to 3.00	1.00 to 2.00	2.00	....
100	1.65	8.00	....	1.00	2.00	....
....	....	....	....	....	....	....
100	....	10.00	4.00	1.00	....	....
....	....	....	....	....	....	....
100–200	1.65 to 2.50	4.00 to 5.00	5.00 to 5.50	1.00 to 3.00	1.00 to 3.00	....
100–200	1.65 to 2.50	4.00 to 5.00	4.00 to 5.00	1.00 to 3.00	1.50 to 3.00	....
100–200	2.50 to 3.25	....	....	18.50-21.00	....	....
100–200	....	10.00-12.00	2.00 to 4.00	1.00 to 3.00	....	....
100–200	2.50 to 3.50	7.00 to 9.00	3.00 to 4.00	1.00 to 3.00	2.00 to 3.00	....
100–200	....	....	....	....	12.00 14.00	....
100–200	....	13.00-14.00	2.00 to 5.00	1.00 to 3.00	....	....
100–200	1.65 to 3.29	5.00 to 6.50	5.00 to 6.50	1.00 to 3.00	2.00 to 4.25	....
100–200	1.70 to 2.67	4.00 to 8.00	4.74 to 6.74	1.00 to 3.00	2.00 to 4.25	....
100–200	3.85	3.75	1.25	1.00	1.00	....
100–200	1.65 to 2.50	4.00 to 5.00	4.00 to 5.00	1.00 to 3.00	1.50 to 3.00	....
100–200	3.00 to 5.00	4.00 to 6.00	2.00 to 4.00	1.00 to 3.00	5.00 to 7.00	....
100–200	2.00 to 2.88	4.00 to 5.00	3.00 to 4.00	1.00 to 3.00	1.50 to 3.00	....
100–200	1.65 to 2.50	4.00 to 5.00	4.00 to 5.00	1.00 to 3.00	1.50 to 3.00	....
100–200	2.75 to 4.00	....	....	15.00-20.00	3.00 to 4.00	....
100–200	....	....	....	....	48.00-50.00	....
100–200	....	....	....	....	49.00-51.00	....
100–200	1.65 to 2.50	4.00 to 5.00	5.00 to 5.50	1.00 to 3.00	1.50 to 3.00	....
100–200	....	8.00 to 9.00	2.00 to 3.00	1.00 to 3.00	4.00 to 4.50	....
100–200	....	8.00 to 9.00	2.00 to 3.00	1.00 to 3.00	2.00 to 2.50	....
100–200	15.00-16.00	....	....	....	....	....
100–200	1.65 to 2.50	7.00 to 7.50	2.00 to 2.50	1.00 to 3.00	1.00 to 1.50	....
100–200	1.65 to 2.50	7.00 to 7.50	2.00 to 2.50	1.00 to 3.00	1.00 to 1.50	....
100	1.65	8.00	2.00	1.00	1 50	....
100	1.65	8.00	1.00	1.00	1.00	....
100	2.05	6.00	2.00	1.00	1.00	....
100	2.90	5.00	1.00	1.00	1.00	....
100	3.30	6.00	2.00	2.00	4.00	....
100	2.50	4.00	2.00	1.00	7.00	....
100	....	14.00	2.00	1.00	....	....

Brand.	Name of Dealer or Manufacturer.	Domicile of Dealer or Manufacturer.
Tankage	Swift & Co.	Chicago, Ill.
Tankage	Swift & Co.	Kansas City, Kan.
Tankage	Swift & Co.	St. Joseph, Mo
Tankage	Swift & Co.	St. Paul, Minn
Tankage	Swift & Co.	Omaha, Neb.
Tankage	Swift & Co.	East St. Louis, Ill
Tankage	Swift & Co.	Fort Worth, Tex
Tankage	Swift & Co.	
Tankage	Swift & Co.	
Tankage	Swift & Co.	
Tankage	Swift & Co.	
H. G. Ground Tankage	Swift & Co.	
Swift's Special High Grade Guano	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Monarch H. G. Guano	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Cotton King H. G. Guano	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Eagle H. G. Guano	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Golden Harvest H. G. Guano	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Red Steer H. G. Guano	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Cotton Plant H. G. Guano	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Plow Boy H. G. Guano	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Yazoo Standard Grade Guano.	Swift Fertilizer Works	Atlanta, Ga, and E. St. Louis, Ill.
Swift's Atlanta H. G. Phosphate and Potash	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Farmers Home H. G. Phosphate and Potash	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Plantation St. G. Phosphate and Potash	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's German Kainit	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis. Ill.
Swift's Wheat Grower St. G. Phosphate & Potash	Swift Fertilizer Works	Atlanta, Ga, and E. St. Louis, Ill.
Swift's Field & Farm St. G. Phosphate & Potash	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Cultivator H. G. Acid Phosphate	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Chattahoochee St. G. Acid Phosphate	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis. Ill
Swift's Bone Meal and High Grade	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.
Swift's Raw Bone Meal and High Grade	Swift Fertilizer Works	Atlanta, Ga. and E. St. Louis, Ill.

Weight of Package.	Nitrogen.	PHOSPHORIC ACID. Soluble	PHOSPHORIC ACID. Reverted	PHOSPHORIC ACID. Insoluble	Potash.	Ammonia.
100-167	....	....	....	4.58	....	11.00
100-167	....	....	....	6.87	....	10.00
100-167	....	....	....	6.87	....	9.00
100-167	....	....	....	9.16	....	8.00
100-167	....	....	....	11.45	....	7.00
100-167	....	....	....	13.74	....	6.00
100-167	8.25	Total Phosphoric Acid, 4.58			....	....
100-167	7.41	Total Phosphoric Acid, 4.58			....	....
100-167	6.58	Total Phosphoric Acid, 4.58			....	....
100-167	5.76	Total Phosphoric Acid, 4.58			....	....
100-167	4.94	Total Phosphoric Acid, 4.58			....	....
100-167	....	....	....	....	....	....
100-200	4.12	6.00	2.00	1.00	3.00	....
100-200	3.29	5.00	2.00	1.00	4.00	....
100-200	2.47	5.00	2.00	1.00	2.00	....
100-200	1.65	7.00	2.00	1.00	2.00	....
100-200	1.65	5.00	2.00	1.00	2.00	....
100-200	1.65	5.00	2.00	1.00	2.00	....
100-200	1.65	6.00	2.00	1.00	1.00	....
100-200	.82	7.00	2.00	1.00	1.00	....
100-200	1.65	4.00	2.00	1.00	1.00	....
100-200	....	9.00	2.00	1.00	4.00	....
100-200	....	7.00	2.00	1.00	4.00	....
100-200	....	5.00	2.00	1.00	4.00	....
100-200	....	....	....	....	12.00	....
100-200	....	7.00	2 00	1.00	2.00	....
100-200	....	7.00	2.00	1.00	2.00	....
100-200	....	11.00	2.00	1.00	....	....
100-200	....	9.00	2.00	1.00	....	....
100-200	2 47	25.00 Total Phosphoric Acid			....	....
100-200	3.29	23.00 Total Phosphoric Acid			50.00	....

Brand.	Name of Dealer or Manufacturer.	Domicile of Dealer or Manufacturer.
Swift's Muriate Potash	Swift Fertilizer Works	Atlanta, Ga. and E. St, Louis, Ill.
Swift's Muriate Soda	Swift Fertilizer Works	Atlanta, Ga. aud E. St. Louis, Ill.
Ox Slaughter House Bone.	Tennessee Chemical Co	Nashville, Tenn
Royal H. G. Guano	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Cotton Boll Guano	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Animal Bone Guano	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Blood, Bone and Potash	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Scott's Gossypium Phospho	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery. Ala
Scott's Std. State Guano	Virginia-Carolina Chem. Co.	Memphis, Tenn,, Mobile and Montgomery, Ala
Scott's Ammoniated Bone.	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Scott's Meal Formula	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Vegetable Fertilizer	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Fruit Grower	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
V. C. Garden Truck Special	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
V. C. C. Fruit and Truck Special	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Fruit Tree Special	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Potash Compound	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Grain Grower	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala

Weight of Package.	Nitrogen.	PHOSPHORIC ACID.			Potash.	Ammonia.
		Soluble	Reverted	Insoluble		
100-200					50.00	
100-200	13.17					
200	1.65	6.00	2.00	1,00	2.00	
100-200	1.65 to 2.50	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	2.00 to 3.00	
100-200	1.65 to 2.50	6.00 to 7.00	2.00 to 3.00	2.00 to 3.00	2.00 to 3.00	
100-200	1.65 to 2.50	7.00 to 8.00	2.00 to 3.00	2.00 to 3.00	1.00 to 2.00	
100-200	.82 to 1.65	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	1.00 to 2.00	
100-200	1.65 to 2.50	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	2.00 to 3.00	
100-200	1.65 to 2.50	6.00 to 7.00	2.00 to 3.00	2.00 to 3.00	2.00 to 3.00	
100-200	1.65 to 2.50	7.00 to 8.00	2.00 to 3.00	2.00 to 3.00	1.00 to 2.00	
100-200	.82 to 1.65	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	1.00 to 2.00	
100-200	2.47 to 3.30	6.00 to 7.00	2,00 to 3.00	2.00 to 4.00	4.00 to 5.00	
100-200	2.47 to 3.30	6.00 to 7.00	2.00 to 3.00	2.00 to 4.00	5.00 to 6.00	
100-200	4.94 to 5.76	4.00 to 5.00	2.00 to 3.00	2.00 to 3.00	4.00 to 5.00	
100-200	3.30 to 4.13	4.00 to 5.00	2.00 to 3.00	2.00 to 3.00	8.00 to 9.00	
100-200	1.23 to 2.00	7.00 to 8.00	3.00 to 4.00	2.00 to 3.00	8.00 to 10.00	
100-200		8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	4.00 to 5.00	
100-200		8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	4.00 to 5.00	

Brand.	Name of Dealer or Manufacturer.	Domicile of Dealer or Manufacturer.
Royal Compound	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Acid Phosphate	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Dissolved Bone	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Scott's H. G. Acid Phos.	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Scott's Potasso Phospho.	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
German Kainit, Imported.	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
I. X. L. Acid Phosphate	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Mobile Dble. Eagle Guano	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Mobile Standard Guano	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Eclipse Soluble Guano	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Mont. gomery, Ala
V. C. C. Co.'s Truck Grower	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
V. C. C. Co.'s Ammoniated Fertilizer	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Pure Raw Animal Bone	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal H. G. Guano.	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Scott's Gossypium Phospho	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Mobile Dble. Fagle Guano	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Scott's Meal Formula	Virginia-Carolina Chem, Co.	Memphis, Tenn., Mobile and Montgomery, Ala

Weight of Package.	Nitrogen.	PHOSPHORIC ACID.			Potash.	Ammonia.
		Soluble	Reverted	Insoluble		
100-200	....	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	2.00 to 3.00	....
100-200	....	10.00-11.00	2.00 to 3.00	2.00 to 3.00	....	....
100-200	....	12.00-13.00	2.00 to 3.00	2.00 to 3.00	....	....
100-200	....	12.00-13.00	2.00 to 3.00	2.00 to 3.00	....	....
100-200	....	9.00 to 10.00	3.00 to 4.00	2.00 to 3.00	2.00 to 3.00	....
100-200	....	....	....	....	12.00-14.00	....
100-200	....	9.00 to 10.00	3.00 to 4.00	2.00 to 3.00	....	....
100-200	1.65 to 2.50	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	2.00 to 3.00	....
100-200	....	....	....	....	....	....
100-200	1.65 to 2.50	6.00 to 7.00	2.00 to 3.00	2.00 to 3.00	2.00 to 3.00	....
100-200	1.65 to 2.50	7.00 to 8.00	2.00 to 3.00	2.00 to 3.00	1.00 to 2.00	....
100-200	2.06 to 3.00	6.00 to 7.00	2.00 to 3.00	2.00 to 4.00	6.00 to 8.00	....
100-200	.82 to 1.65	7.00 to 8.00	3.00 to 4.00	2.00 to 3.00	3.00 to 4.00	....
100-200	3.30 to 4.12	Total Phosphoric Acid, 20.00-25.00			....	....
100-200	1.65 to 2.50	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	1.50 to 2.50	....
100-200	1.65 to 2.50	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	1.50 to 2.50	....
100-200	1.65 to 2.50	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	1.50 to 2.50	....

Brand.	Name of Dealer or Manufacturer.	Domicile of Dealer or Manufacturer.
Royal Blood, Bone and Potash	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Acid Phosphate	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
I. X. L. Acid Phosphate	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Royal Bone Superphosphate	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Capital Bone and Potash Compound	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
V. C. Superphosphate	Virginia-Carolina Chem. Co.	Memphis, Tenn., Mobile and Montgomery, Ala
Claiborne Mixture No. 1	Homer C. O. Co., Ltd.	Homer, La.
Claiborne Mixture No. 2	Homer C. O. Co., Ltd.	Homer, La.
Fortune Brand	Jefferson Gin and Oil Mill	Harriston, Miss
Jefferson H. G. Acid Phos.	Jefferson Gin and Oil Mill	Harriston, Miss
Acid Phosphate	Lagarde Bros.	New Orleans.
Acid Phosphate	Grasselli Chemical Co.	Birmingham, Ala.
High Gr. Acid Phosphate	Minden C. O. & Ice Co., Ltd	Minden, La.
North La. Std. Fertilizer	Minden C. O. & Ice Co., Ltd	Minden, La.
Black Diamond Acid Phos.	New Orleans Acid and Fert. Co	Gretna, La.
Crescent City Acid Phos.	New Orleans Acid and Fert. Co	Gretna, La.
High Grade Acid Phos,	New Orleans Acid and Fert. Co	Gretna, La.
Dissolved Bone and Potash	New Orleans Acid and Fert. Co	Gretna, La.
Goldsmith's Improved Mix.	New Orleans Acid and Fert. Co	Gretna, La.
Gold Dust	New Orleans Acid and Fert. Co	Gretna, La.
Blood, Bone and Potash	New Orleans Acid and Fert. Co	Gretna, La.
Blood, Bone and Beef	New Orleans Acid and Fert. Co	Gretna, La.
Vegetable Grower	New Orleans Acid and Fert. Co	Gretna, La.
Creole S. C. Grower	New Orleans Acid and Fert. Co	Gretna, La.
Special S. C. Grower, 67	New Orleans Acid and Fert. Co	Gretna, La.
Special S. C. Grower, 106	New Orleans Acid and Fert. Co	Gretna, La.

Weight of Package.	Nitrogen.	PHOSPHORIC ACID.			Potash.	Ammonia.
		Soluble	Reverted	Insoluble		
100.200	1.65 to 2.50	7.00 to 8.00	2.00 to 3.00	2.00 to 3.00	1.00 to 2.00	....
100-200	....	12.00-13.00	2.00 to 3.00	2.00 to 3.00	....	....
100-200	....	12.00-13.00	2.00 to 3.00	2.00 to 3.00	....	....
100-200	....	12.00-13.00	3.00 to 4.00	2.00 to 3.00	....	....
100-200	....	8.00 to 9.00	2.00 to 3.00	2.00 to 3.00	2.00 to 3.00	....
100-200	....	12.00-13.00	4.00 to 5.00	2.00 to 3.00	....	....
100	1.75	8,00	2.00	1.00	.50	....
100	3.00	4.00	2.00	1.00	1,00	....
100-200	1.98	....	9.25	....	1.25	....
100-200	....	....	14,00	....	....	....
100	....	....	....	....	....	....
100	....	16.00 Available Phosphoric Acid			....	....
100	....	12.00	2.00	2.00	....	....
100	1.75	8.00	2.00	1.00	....	....
100-200	....	10.00	2.00	2.00	....	....
100-200	....	10.00	2.00	2.00	....	....
100 200	....	13.00	2.00	2.00	....	....
100-200	....	8.00	2.00	2.00	2.00	....
100-200	1.65	7.00	2.00	2.00	1.00	....
100-200	1.65	7.00	2.00	2.00	1.00	....
100-200	1.65	7.00	2.00	2.00	1.00	....
100-200	1,65	7.00	2.00	2.00	1.00	....
100-200	2.80	6.00	1.25	2.00	2.60	....
100-200	2.50	6.00	2.00	2.00	....	....
100-200	5.00	5.00	2.00	2.00	....	....
100-200	8.00	4.00	2.00	2.00	....	....

REGISTRATION OF COTTON SEED MEAL AND MEAL FERTILIZER BRANDS BY MANUFACTURERS AND DEALERS, FOR THE SEASON 1903-1904, IN COMPLIANCE WITH ACT 48 OF 1902.

BRAND.	Name of Dealer or Manufacturer.	Domicile of Dealer or Manufacturer.	Weight of Package.	Nitrogen.	Ammonia.
Purina Cotton Seed Meal	Arcadia C. O. Mill & Mfg. Co.	Arcadia, La.	100	7.00	
Cotton Seed Meal	F. W. Brode & Co.				
	Memphis C. O. Co.	Memphis, Tenn.	100	6.00-7.00	
Cotton Seed Meal	Bastrop Oil & Fertz. Works, Ltd.	Bastrop, La.	100	8.50	
Cotton Seed Meal	Breaux Bridge Oil Works, Ltd.	Breaux Bridge, La.	100	6.55-7.00	7.95
Cotton Seed Meal	Boyce C. O. & Mfg. Co.	Boyce, La.	100		
Prime Meal	Boyce C. O. & Mfg. Co.	Boyce, La.	100	6.55	8.00
Prime Meal	Boyce C. O. & Mfg. Co.	Boyce, La.	100	6.79	8.00
Off Meal	Boyce C. O. & Mfg. Co.	Boyce, La.	100	6.17	7.50
Cotton Seed Meal Fertilizer	H. S. Crozier	New Orleans, La.			
	The National C. S. Products Co.	Memphis, Tenn.	100	8.00	
Cotton Seed Meal	Clinton O. & Mfg. Co.	Clinton, La.	100	6.00	
Cotton Seed Meal	Capital City Oil Mill Co.	Baton Rouge, La.	100	6.00-7.00	
Cotton Seed Meal	Concordia O. M. Co., Ltd.	Vidalia, La.	100	7.00	
Cotton Seed Meal	Fayette Oil Works	Fayette, Miss.	100	6.00-7.00	
Cotton Seed Meal	Feliciana Oil Mill	St. Francisville, La.	100	6.00-7.00	
Cotton Seed Meal	Grand Ecore C. O. Co.	Natchitoches, La.	100	6.00-7.00	
Cotton Seed Meal	B. F. Glover	New Orleans, La.	100	5.00	
Cotton Seed Meal	Gloster Oil Works	Gloster, Miss.	100	6.00-7.00	
Cotton Seed Meal	J. T. Gibbons	New Orleans, La.			
	Planters' Oil Mill	Monroe, La.	100		6.00-7.00
Cotton Seed Meal	J. T. Gibbons	New Orleans, La.			
	Southern Oil & Fertz. Co.	Meridian, Miss.	100		6.00-7.00
Cotton Seed Meal	E. F. George	New Orleans, La.			
	Drew Oil Mill	Monticello, Ark.	100	8.00	
Cotton Seed Meal	Hazlehurst O. M. & Fertz. Co.	Hazlehurst, Miss.	100	6.00	8.00
Cotton Seed Meal	Homer C. O. Co.	Homer, La.	100	6.00-7.00	
Cotton Seed Meal	Jackson Fertz. Co.	Jackson, Miss.	100	6.25	
Cotton Seed Meal	Jefferson Gin & Oil Mill Co.	Harriston, Miss.	100	6.70	
Cotton Seed Meal	Lagrade Bros.	New Orleans, La.			
	Rodney Gin & Oil Co.	Rodney, Miss.	100		8.00
Cotton Seed Meal	Lecompte C. O. Co., Ltd.	Lecompte, La.	100	6.00-7.00	
Cotton Seed Meal	A. F. Leonhardt & Co.	New Orleans, La.			
	Summit Gin & Improvement Co.	Summit, Miss.	100	6.00	
Cotton Seed Meal	Lagrade Bros.	New Orleans, La.			
	Hill City Oil Works	Vicksburg, Miss.	100		8.00

Cotton Seed Meal Standard	Minden C. O. & Ice Co., Ltd.	Minden, La.	100	7.00	8.00
Cotton Seed Meal	National Cotton Seed Products Co.	Little Rock, Ark.	100	6.50-7.00	....
Cotton Seed Meal	New Roads O.M. & Mfg. Co., Ltd.	New Roads, La.	100	6.00	....
Cotton Seed Meal	New Iberia Milling & Development Co. Ltd.	New Iberia, La.	100	6.00-7.00	....
Cotton Seed Meal	New Orleans Acid & Fertz. Co.	Gretna, La.	100	6.00	....
Cotton Seed Meal	New Orleans C. S. Oil & Mfg. Co., Ltd.	New Orleans, La.	100	6.00	....
Cotton Seed Meal	Port Gibson Oil Works	Port Gibson, Miss.	100	5.00-6.00	....
Cotton Seed Meal	People's C. O. Co.	Lafayette, La.	100	7.40	8.98
Cotton Seed Meal	Planters' Oil Mill	Monroe, La.	100	6.50	....
Cotton Seed Meal	Red River Oil Co., Ltd.	Alexandria, La.	100	6.59	8.00
Cotton Seed Meal	Red River Oil Co., Ltd.	Alexandria, La.	100	6.79	8.25
Off Cotton Seed Meal	Red River Oil Co., Ltd.	Alexandria, La.	100	6.17	7.50
Cotton Seed Meal	Raccourci C. O. Co.	Batchelor, La.	100	6.50-7.00	8.00
Cotton Seed Meal	Ruston Oil Mills & Fertz. Co.	Ruston, La.	100	7.00	....
Cotton Seed Meal	H. B. Schrieber & Bro.	New Orleans, La.			
	Capital City Oil Mill Co.	Baton Rouge, La.	100	6.00-7.00	....
Off Cotton Seed Meal	Standard Guano & Chemical Mfg. C.	New Orleans, La.	100	4.12-5.76	....
Prime Cotton Seed Meal	Standard Guano & Chemical Mfg. C.	New Orleans, La.	100	5.76-7.41	....
Cotton Seed Meal	Shreveport Fertz. Co.	Shreveport, La.	100	4.75	....
Cotton Seed Meal	Sonia C. O. Co., Ltd.	Alexandria, La.	100	6.59	....
Cotton Seed Meal	Steinhardt & Co.	New Orleans, La.			
Cotton Seed Meal	Dallas C. O. Co.	Dallas, Texas	100	6.00-7.00	....
Cotton Seed Meal	Steinhardt & Co.	New Orleans, La.			
Cotton Seed Meal	Various Mills	....	100	6.00-7.00	....
Cotton Seed Meal	St. Landry Cotton Oil Co.	Opelousas, La.	100	6.59	....
Cotton Seed Meal	St. Martin's Oil Works, Ltd.	St. Martinsville, La	100	7.00-8.00	....
Cotton Seed Meal	St. Martin's Oil Works, Ltd.	St. Martinsville, La		....	7.00
Cotton Seed Meal	Tensas C. O. & Mfg. Co.	St. Joseph, La.	100	6.00-7.00	....
Cotton Seed Meal	The Union Oil Co.	Gretna, La.	100	6.59	....
Cotton Seed Meal	The Union Oil Co.	Vidalia, La.	100	6.59	....
Cotton Seed Meal	The Union Oil Co.	Bunkie, La.	100	6.59	....
Cotton Seed Meal	The Union Oil Co.	West Monroe, La.	100	6.59	....
Cotton Seed Meal	The Union Oil Co.	Torras, La.	100	6.59	....
Cotton Seed Meal	The Union Oil Co.	Shreveport, La.	100	6.59	....
Cotton Seed Meal	Washington C. O. Co.	Washington, La.	100-200	6.59	....

Tabulation showing number of registrations and brands registered by manufacturers of commercial and cotton seed meal fertilizers offering these commodities for sale for use in Louisiana during Season 1903-1904, classified according to registration by manufacturers domiciled in State mentioned below:

	CLASS.			
	C. S. M. Fertz.		Com. Fertz.	
STATE—	No. Mfgrs.	No. Brands.	No. Mfgrs.	No. Brands.
Alabama	...	...	4	41
Arkansas	2	2	...	...
Georgia	...	...	2	31
Illinois	...	...	4	42
Kansas	...	...	1	11
Louisiana	38	43	12	78
Minnesota	...	...	1	11
Missouri	...	...	2	12
Mississippi	10	10	7	31
Nebraska	...	...	3	20
Ohio	...	...	1	1
Tennessee	2	2	4	49
Texas	1	1	2	19
Total number of cotton seed meal registrations	53	...	...	...
Total number commercial fertilizer registrations	43	...	43	...
Total number registrations	96	...	...	...
Total number brands cotton seed meal registered	...	58	...	...
Total number brands commercial fertilizer registered	...	346	...	346
Total number brands registered	...	404	...	...

BATON ROUGE, LA., October 1, 1904.

Mr. Chas. H. O'Rourke, Chief Inspector of Fertilizers, New Orleans, La.:

DEAR SIR—In compliance with your letter of recent date, I beg to submit my final report for the Season 1903-1904, and I regret that, owing to illness, as also to the large volume of work to be done in my office, my inability to report sooner.

As compared with the work of last season, the tonnage for Baton Rouge District shows a decreased number of insepctions, amounting to 135; while the total tonnage shows an increase amounting to 364.59 tons and 3,527 sacks.

The total business for the season amounted to 549 shipments, 14,257.39 tons and 256,330 sacks. Of this total, 87 shipments, 2,610.64 tons and 47,017 sacks were not inspected, owing to the great amount of clerical work included in my duties during the past season in the Board of Agriculture and Immigration office; thus leaving a total number of inspections amounting to 462 shipments, 11,646.75 tons and 209,313 sacks inspected.

Of this lot, 324 inspections, 6,639.95 tons and 132,799 sacks of cotton seed meal fertilizer were inspected by the Sub-Inspectors of Baton Rouge District; while my inspections of this class of fertilizer amounted to:

	Inspections.	Tons.	Sacks.
	21	635.50	12,710
Of the commercial fertilizer.	32	789.30	15,384
Of tankage fertilizer........	85	3,582.00	48,420
Making a total of......	138	5,006.80	76,514

The work for the past season has involved much detail, and in one or two instances, shipments were delayed by the Department, subject to "Thorough invkestigation." It affords pleasure to be able to state that the evidence adduced in each instance showed clearly there was not intentional desire to violate the law.

Among the impovements that might be made upon the suggestion of the active inspection force throughout the State, I desire to add my suggestion that the present plan of sub-inspections by individuals at the different oil mills, in this District, be done away with and the system be so re-established as to insure direct inspection of cotton seed meal, both as "a live stock food and a fertilizer" by individual representatives, directly employed by this Department. The addition of commercial food stuffs to the list of commodities requiring our attention and the desire of Commissioner Lee for efficient and acurate service in the work, besides the more substantial business regularity and uniformity that it would obtain—these have prompted me to make this recommendation, and those who have served me faithfully and well as sub-inspectors of this District and have assisted me so materially in the work accomplished during the past two seasons, must not misunderstand this recommendation to reflect upon their work. I make this recommendation, prompted by the knowledge that it is best for the Department for whose welfare and glory we have all labored.

In submitting this report, I desire to thank you and all connected with the work for able and efficient assistance rendered. I desire to extend sincere thanks of this District to the farmers and planters and their managers, as also representatives, the agents of railroad and transportation companies, who have kindly lent their assistance to the work, and trust this letter meets with your approval.

Yours respectfully,
(Signed) MILLARD S. PERKINS.

(Copy.)

CALHOUN, LA., October 7, 1904.

Mr. Chas. H. O'Rourke, Chief Inspector of Fertilizers, New Orleans, La.:

DEAR SIR—In compliance with your request of recent date, beg to submit my final report for Season 1903-1904:

During the season 614 inspections were made, amounting to 14,790.05 tons, 246,811 sacks, as follows:

	Inspections.	Tons.	Sacks.
Cotton Seed Meal Fertilizer—			
Inspected by Sub-Inspectors.	155	4,768.00	92,364
By N. E. Calhoun	14	243.80	4,876

Commercial Fertilizer—			
Inspected by Sub-Inspectors.	140	2,905.20	13,324
By N. E. Calhoun	205	6,873.05	136,247
Non-inspections (shipments 29)	....	403.00	10,075

Of the 29 non-inspections of commercial fertilizer, seven (7) were of the Shreveport Fertilizer Company's goods and should have been reported to Captain Sellers. The remaining 22 non-inspections were caused in almost every instance by the goods being delayed in transit, and not arriving at destination until after I had made the trip to inspect it, and on account of the enormous amount of work at that season, I could not make a second trip to reach it. In regard to the Sub-inspection Department, I am yet at a loss as to what is best to be done. Though I think after conferring with you and Major Lee in person, we may arrive at some plan by which we can improve the present system. I am fully aware that, at least, a part of our sub-inspection system is not best for all concerned. Especially do I refer to those sub-inspectors who are in any way connected with the oil mills. Inasmuch as results, by use of commercial fertilizers, in North Louisiana, during this season, have been satisfactory, the indications are for a large increase another season. Also the inspection of commercial feed stuffs will necessitate more work for the Inspectors. Therefore, I am persuaded that a change of the sub-inspectors will be to the best interest of the Department.

In conclusion I desire to thank you for the assistance rendered me during the season and assure you that I shall put forth every effort to reach the highest standard of perfection in the Inspection Department.

With best wishes, I am very cordially,

(Signed) N. E. Calhoun,
Inspector.

Calhoun District.
(Copy.)

Murphy P. O. La., October 7, 1904.

To Mr. Chas. H. O'Rourke, Chief Inspector Fertilizers, No. 714 Union Street, Main Office, New Orleans.

Dear Sir—There were 312 inspections and 10 non-inspections made in this, the Terrebonne District, Season 1903-1904.

	Inspections.	Tons.	Sacks.
Cotton Seed Meal Fertilizer—			
Inspections by sub-inspectors	115	3,619.10	71,382
Inspections by myself	34	1,476.00	29,760
Non-inspections, 5 inspections	155	....	3,100
	149	5,197.10	10,142
Commercial Tankage—			
Inspected by myself	13	286.00	4,820
Non-inspections by myself, 3 inspections	....	50.00	1,000
Tankage—			
Inspected by myself	150	5,529.10	67,693
Non-inspections by myself, 2 inspections	....	50.00	599
Non-inspections, 10	....	255.00	46,995
Inspections	312	10,912.20	173,665

The work in this District has not been quite as hard as previous years, and I think now that we have a road running from Franklin to Abbeville and another running from Raceland on Bayou Lafourche to Lockport, it will facilitate traveling very much in moving rapidly through the country—especially in bad weather.

There is one thing I would call your attention to, and that is the present mode of inspecting cotton seed meal fertilizers. The planters want the inspections made on the plantations—I have heard several complaints. There is another trouble about inspecting at mills that causes some confusion in my District. The planter gets has consignment before he gets any notice of inspection or his analysis, and he at once calls up by telephone District Inspector or forwards sample to State Chemist. Where meal is shipped from outside of District it is difficult for District Inspector to know whether it has been inspected or not. Had it not been for the promptness on part of the planters in notifying me of arrival of meal, several lots would not have been inspected, as there was no notification of shipment. Too much cannot be said in favor of the planters in Terrebonne District for their uniform assistance in inspecting fertilizers and kindness in every way.

The officers of the Southern Pacific Railroad and Teche Line boats have rendered me every assistance possible in their power.

With many kind wishes, your friend,

(Signed) J. C. MURPHY.

(Copy.)

From this report of tonnage you will readily see from the evidence of increased business, that the Inspection Department of the State Board of Agriculture and Immigration has reached proportions that place it prominently upon a higher plane of responsibility and has brought within its scope the important duty of not only controlling the legitimate commerce in fertilizers and Paris Green, in the expansion and development of a field that has made remarkable strides in the past four years, but also embraces the supervision of feed stuffs in accordance with the requirements of Act 153 of 1904 under your guidance and direction.

Tabulation showing actual tonnage covered by reports (both inspection and non-inspection reports), but not including sub-inspection department. Tonnage for Seasons 1902-1903, 1903-1904, of Inspection Department throughout its entire system for the Seasons 1900-1901, 1901-1902, 1902-1903 and 1903-1904.

	Season 1900-1901.		Season 1901-1902.	
District—	Reports.	Tons.	Reports.	Tons.
Baton Rouge	104	5,243.86	117	7,127.50
Calhoun	229	2,768.15	325	4,780.98
Leesville	25	335.75	101	1,401.00
Terrebonne	243	8,017.56	228	7,775.98
New Orleans	1,793	27,193.07	2,057	28,118.96
	2,394	43,558.39	2,888	49,204.42

	Season 1902-1903.		Season 1903-1904.	
District—	Reports.	Tons.	Reports.	Tons.
Baton Rouge	262	7,823.10	225	7,617.44
Calhoun	323	4,339.50	348	7,519.85

Leesville	100	1,363.05	254	3,380.20
Terrebonne	222	8,649.10	207	7,548.10
New Orleans	4,061	45,709.50	3,306	37,117.72
	4,968	67,884.25	4,340	63,183.31

Tabulation showing actual tonnage covered by reports of sub-inspection department, Seasons 1902-1903 and 1903-1904.

	Season 1902-1903.		Season 1903-1904.	
District—	Reports.	Tons.	Reports.	Tons.
Baton Rouge	335	6,069.70	324	6,639.95
Calhoun	212	4,163.10	295	7,673.20
Terrebonne	124	3,715.25	115	3,619.10
	671	13,948.05	594	15,027.05

Commercial Fertilizers—140 inspections, 2,905.20 tons, 13,724 sacks.

GENERAL RECAPITULATION.

	Season 1900-1901.		Season 1901-1902.	
District—	Reports.	Tons.	Reports.	Tons.
Baton Rouge	104	5,243.86	177	7,127.50
Calhoun	229	2,768.15	325	4,780.98
Leesville	25	335.75	101	1,401.00
Terrebonne	243	8,017.56	228	7,775.98
New Orleans	1,793	27,193.07	2,057	28,118.96
	2,394	43,558.39	2,888	49,204.42

	Season 1902-1903.		Season 1903-1904.	
District—	Reports.	Tons.	Reports.	Tons.
Baton Rouge	597	13,892.80	549	14,257.39
Calhoun	535	8,502.60	643	15,193.05
Leesville	100	1,363.05	250	3,356.20
Terrebonne	346	12,364.35	322	11,167.20
New Orleans	2,483	31,799.80	3,306	37,117.72
	4,061	67,922.60	5,070	81,091.56

ACT No. 174.

By Mr. Smith, of Rapides. House Bill No. 306.

AN ACT

To protect and advance agriculture by regulating the sale and purity of Paris Green used as an insecticide; by establishing the guarantees and conditions upon which it is to be sold, and by fixing the penalties incurred by violation of such conditions; by providing for its inspection and analysis, and establishing the liability of the seller to the purchaser, when the analysis falls below the guarantee given; by providing for the collection of the money and the disposition thereof. And to repeal all laws in conflict with or inconsistent with this act.

Section 1. Be it enacted by the General Assembly of the State of Louisiana, That the Louisiana State Board of Agriculture and Immigration shall be charged with the duties of regulating the sale and purity of Paris Green used as an insecticide in this State.

Sec. 2. Be it further enacted, etc., That it shall be the duty of the Louisiana State Board of Agriculture and Immigration, or its Commissioner, at the opening of each season to issue and distribute circulars setting forth the brands of Paris Green and their percentage of arsenic as claimed by the dealers, and to more particularly describe them they shall be separated into two classes, viz:

Those brands containing fifty per cent or more of arsenic shall be classed as ''strictly pure;'' and, second, all falling below this percentage shall be classed as ''impure.''

Sec. 3. Be it further enacted, etc., That it shall be the duty of the Commissioner of Agriculture and Immigration to cause to be prepared ''labels'' of suitable material, fit to be attached to packages of Paris Green, and to have printed thereon the word, ''Guaranteed,'' with a blank space into which may be stamped by the Commissioner of Agriculture and Immigration the words, "Strictly pure," or "Impure," as the guarantee may require; also the year or season in which the same are to be used, and a fac-simile of the signature of said Commissioner. The said labels shall be furnished by the said Commissioner to any dealer in Paris Green who shall have complied with the provisions of this act upon payment by the said dealer to the said Commissioner of fifty cents for a sufficient number to label one hundred pounds of said Paris Green. All Paris Green carried over in stock from one year to another by merchants and dealers shall be re-stamped at the commencement of each year, which is hereby set as May 1st, and such stock so carried over shall be re-stamped at the expense of such merchant or dealer at the rate of one-half cent per pound, and shall be subject to all requirements of this act. All merchants and dealers having stock on hand on April 30th of each year are hereby required to notify the Chief Inspector of Fertilizers of the quantity of Paris Green they have on hand, the quantity of Paris Green purchased since May 1st of the previous year, itemizing each shipment according to date, number of pounds, number of packages, and stating plainly from whom each shipment is purchased, and said statement shall be made under oath.

Sec. 4. Be it further enacted, etc., That it shall be the duty of every person before offering for sale any Paris Green as an insecticide in this State to attach or cause to be attached to each package one of the labels hereinbefore described, designating the quantity of Paris Green in the package to which it is attached. Any person who shall counterfeit or use a counterfeit of the label prescribed by this act, or shall use them a second time, shall be guilty of a misdemeanor, and on conviction thereof shall be fined in a sum not exceeding two hundred and fifty dollars; one half of which shall be paid to the informer, which fine may be doubled or trebled at each second or third conviction, and so on progressively for subsequent convictions.

Sec. 5. Be it further enacted, etc., That any person manufacturing, dealing in, selling or soliciting orders in the State of Louisiana for the sale of Paris Green, shall, when he has agreed to sell any lot of Paris Green, notify in writing the Chief State

Inspector of Fertilizers of the sale, the name of manufacturer, the number of pounds, and the number of packages in the lot sold, and the names of the seller and purchaser, and the location and situation of the lot of Paris Green so sold; and when so notified the Inspector of Fertilizers shall proceed to sample said lot and shall forward to the State Chemist such sample for analysis, and the vendor shall not ship or deliver the lot or lots sold to the purchaser until such Inspector has made such inspection; *provided,* that in the event the inspection before shipment or delivery to the purchaser be found to be impracticable; then said inspection shall be made immediately after actual delivery to the purchaser, or so soon thereafter as practicable under the circumstances. Any person who has qualified according to the requirements of this act to deal in Paris Green, and who fails to notify the Chief Inspector of Fertilizers of any shipment of Paris Green which they or their agents make to a point in Louisiana, shall be liable for each violation to a fine not exceeding twenty-five dollars ($25.00), which fine shall be recoverable before any court of competent jurisdiction, at the suit of the Commissioner, without bond or advance cost, and shall revert to the Paris Green fund; five violations of this nature shall be sufficient cause for the revocation of any Paris Green license issued by the Commissioner of Agriculture and Immigration. Any person who shall sell any package of Paris Green which has not been stamped as herein provided shall be guilty of a misdemeanor, and on conviction thereof shall be fined the sum of two hundred and fifty dollars ($250.00) for each lot of Paris Green so sold, and the said person shall be liable, besides, to a penalty of five dollars ($5.00) for each ommission to stamp each package, and each omission to constitute a separate offense, which penalty may be sued for either by the Commissioner or any other person, and shall revert to the Paris Green fund. It being understood that this provision applies to any lot of Paris Green not sufficiently stamped to cover the total number of pounds in any one shipment. And it shall be the duty of the Attorney General and of the several District Attorneys, when requested by the Commissioner, to enjoin any person, firm or corporation, resident or non-resident, from manufacturing or selling or soliciting orders for the sale of Paris Green for use in this State without complying with all the provisions of this act without bond or advance cost. That the Commissioner shall have a privilege on any Paris Green sold in this State in violation and contravention of the provisions of this act, and may proceed by writ of provisional seizure against Paris Green so sold, in the hands of whomsoever the same may be, and wheresoever he may find the same, regardless of the domicile of the owner thereof, to recover the fines and penalties due for the legal sale thereof, by presenting a petition to a competent judge or magistrate within whose jurisdiction said Paris Green is found, stating on oath at the foot of the petition the amount and nature of the demand, the Paris Green on which the privilege exists, praying that the Paris Green be seized to satisfy the claim and pay the costs of suit, and thereafter the proceedings in said suit or suits shall be conducted in the manner provided for in Articles two hundred and ninety-two (292), two hundred and ninety-three (293), two hundred and ninety-four (294) and two hundred and ninety-five (295) of the Code of Practice, all of which are hereby made applicable to the proceedings herein provided for; *provided,* that if there be judgment in favor of plaintiff in such suits, with privilege on the Paris Green, and the same be ordered to be sold to satisfy such judgment, the Commissioner shall, prior to the sale, draw proper sample from said Paris Green, and cause the same to be analyzed by the official Chemist, and shall affix to the package thereof the guarantee stamps as required by this act, so that the purchaser at the sheriff's or constable's sale may purchase the said Paris Green under a full guarantee, as provided for in this act.

Sec. 6. Be it further enacted, etc., That no fradulent Paris Green shall be sold for use in this State, that the price of fraudulent Paris Green shall not be collected by any process of law; that no person buying fraudulent Paris Green in this State, or sold for use in this State, shall be bound in any manner to pay the price or cost thereof; that all Paris Green sold in this State or for use in this State without having been inspected or stamped, as provided for in this act, shall be conclusively presumed to be fraudulent Paris Green, within the meaning of this prohibitive law, the price of which shall not be collected, and all notes, contracts and obligations based on the sale thereof shall be null and void.

SEC. 7. Be it further enacted, etc., That the copy of the official Chemists' analysis of any Paris Green certified to by him shall be admissible as evidence in any court of the State on trial of any issue involving the merits of said Paris Green.

SEC. 8. Be it further enacted, etc., That it shall be the duty of any manufacturer or dealer in original packages of Paris Green before the same is offered for sale in this State, to submit to the Commissioner of Agriculture a written or printed statement, setting forth: First, the brands of Paris Green to be sold; the number of pounds contained in each package in which it is to be put upon the market for sale, and the name or names of the manufacturer and the place of manufacture. Second, the statement setting forth the amount of arsenic which they are willing to guarantee the said Paris Green to contain, and the statement so printed shall be considered as constituting a guarantee to the purchaser that every package of such Paris Green contains not less than the amount of arsenic set forth in the statement.

SEC. 9. Be it further enacted, etc., That every person proposing to deal in Paris Green shall, after filing the statement provided for with the Commissioner of Agriculture and Immigration, receive from the said Commissioner of Agriculture a certificate stating that he has complied with the foregoing section, which certificate shall be furnished by the Commissioner without any charge therefor. That said certificate, when furnished, shall authorize the party receiving the same to deal in this State in Paris Green; that no person who has failed to file the statement aforesaid, and to receive the certificate of authority aforesaid, shall be authorized to deal in this State in Paris Green, and any person so dealing in this State without having filed the aforesaid statement and received the certificate aforesaid, shall be liable, for each violation, to a fine not exceeding two hundred and fifty dollars, which fine shall be recoverable before any court of competent jurisdiction at the suit of the Commissioner of Agriculture and Immigration, or any citizen, and shall be disposed of as hereinafter provided; and *provided further,* that nothing in this section shall be construed as preventing the sale by retail merchants and dealers throughout the State of Paris Green which has already been guaranteed and labeled for the season in and for which the same was purchased, as provided for in this act, and provided the same be not carried over in stock from one year to another in the manner set forth in Section 3 of this act.

Sec. 10. Be it further enacted, etc., That the Bureau of Agriculture and Immigration shall adopt needful rules and regulations providing for the collection of the money arising from the sale of labels, or from any fines imposed under this act, and shall deposit same with the Treasurer of the State, and the funds so constituted shall be drawn therefrom upon warrants issued by the Auditor of the State upon the requisition of the Commissioner of Agriculture and Immigration, made in pursuance of such rules and regulations. All sums of money arising from the provisions of this act shall be known as the "Paris Green Fund," and shall be kept by the Treasurer separate from other public funds, and shall be used to defray expenses and costs of labels, inspections and analysis.

Sec. 11. Be it further enacted, etc., That the Commissioner of Agriculture shall keep a correct and faithful account of all labels received and sold by him, and the amount of money collected therefor, and all money arising from fines under this act.

Sec. 12. Be it further enacted, etc., That all laws or parts of laws in conflict or inconsistent with the provisions of this act be and they are hereby repealed.

R. H. Snyder,
Speaker of the House of Representatives.
P. M. Lambremont,
President Pro Tempore of the Senate.

Approved July 6, A. D. 1904.

Newton C. Blanchard,
Governor of the State of Louisiana.

A true copy:
John T. Michel,
Secretary of State.

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SECOND SERIES, NO. 81.

BULLETIN

OF THE

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

W. R. DODSON, A. B., B. S., Director.

Results of Experiments in Production and Marketing Fruits and Vegetables, and Canning Fruits and Vegetables on a Small Scale, at the

North Louisiana Experiment Station, Calhoun, La.,

BY

D. N. BARROW, B. S., Assistant Director in Charge, and
E. J. WATSON, Horticulturist.

Issued by the State Board of Agriculture and Immigration.
J. G. LEE, COMMISSIONER.

BATON ROUGE:
THE TIMES, OFFICIAL JOURNAL OF LOUISIANA.
1905.

LOUISIANA STATE UNIVERSITY

AND A. & M. COLLEGE.

Louisiana State Board of Agriculture and Immigration.

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H. SKOLFIELD, Treasurer, Baton Rouge, La.

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*Vacant.

The Bulletins and Reports will be sent free of charge to all farmers, by applying to Commissioner of Agriculture, Baton Rouge, La., or to the Director of the Stations, Baton Rouge, La.

PRODUCING AND MARKETING TRUCK.

D. N. Barrow, Assistant Director.

For the past two years there has been a gradual increase in the interest given to truck and fruit growing along the railroad lines of the North Louisiana hill section. This feeling of interest was given fresh impetus by the Truck Institutes held under the auspices of the State Board of Agriculture and Immigration during January of the present year. While the station has done considerable work with fruits and vegetables for a number of years in the way of testing varieties, fertilizers, etc., no effort has been made heretofore to obtain actual cash results. Our experiments have been on a very small scale and shipments were impossible. This season with a view of obtaining commercial results and also of encouraging the local farmers to engage in the shipping of fruits and vegetables, larger areas of the most approved varieties of vegetables were planted, and in cooperation with farmers of the neighborhood carload shipments were made. The results obtained have been most encouraging and the truck movement will go forward on a much larger scale. Not only is this true in regard to the immediate neighborhood, but from all sections from which shipments were made, notably Ruston and Haynesville.

These communities are increasing their acreage and quite a number of new points are preparing to grow truck the coming season. For specific information in regard to varieties of plants grown, yield and prices, the reader is referred to the subjoined report of Mr. E. J. Watson, the horticulturist.

But many of the most important lessons in making a success of fruits and vegetables are not learned from a study of yields and prices. So important a factor toward the success are these lessons that the story would be but half told did we content ourselves with merely publishing these tables, and the attention of the would-be trucker is called to the following points:

EARLINESS.

The first factor to bear in mind is that in order to make a success your product must mature early and be placed upon the market of the more Northern centers before those sections can produce home supply. To obtain this end no pains or trouble should be spared, and all the knowledge and skill of the trained horticulturist should be brought to bear upon it. The hot-bed and cold-frame are indispensable for this purpose, with such plants as will bear transplanting and are too delicate to risk the chance of frost. Many of those contemplating the growing of truck the coming season are not familiar with their construction and directions are here given:

THE HOT-BED.

First: What is a hot-bed, and what is its object? A hot-bed is nothing more than an enclosed seed-bed provided with a cover to retain heat and protect the plants from cold, and supplied with artificial heat to start the plants and make them grow therein while the outside temperature is too low to produce growth.

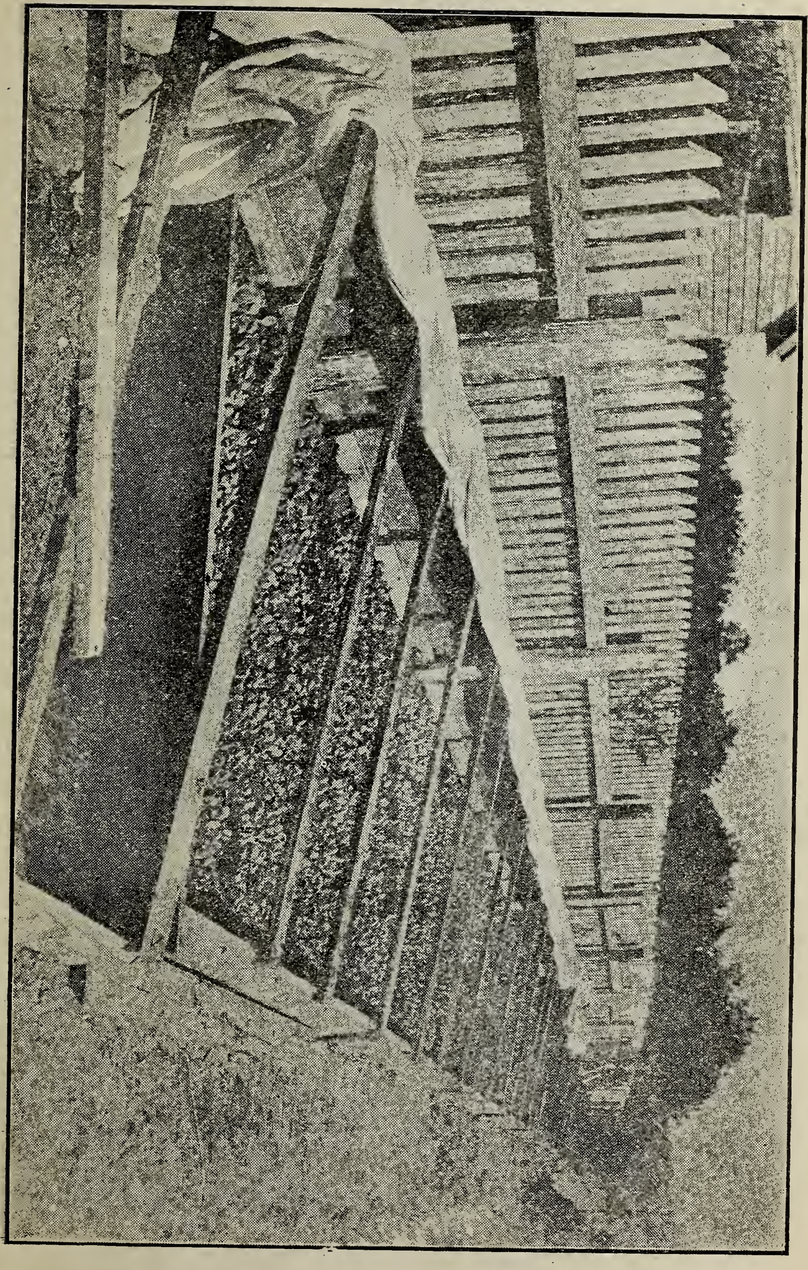
Select for the location of the hot-bed a southern exposure if possible. If this place can be to the south of a building, fence, or other windbreak, so much the better. Dig a pit five feet wide, two feet deep, and as long as desired (ten feet will grow enough plants for an acre), letting the pit run east and west, and throwing all the dirt to the north side. Now drive stakes (2x4 are heavy enough) in the corners and every five feet close to the sides of the pit. These stakes should project three feet above the natural surface of the ground on the north side, and one foot on the south. To these stakes nail 1x12 plank, boxing the bed up to their top as close as possible, and letting the ends slope down from three feet above the ground on the north, to one foot on the south. Provide shed rafters (1x4) for every three feet of length, to hold up the cover. Now bank the dirt, removed from the pit, well up against the north side and the two ends. Your bed is now ready to be filled. For the production of artificial heat in a hot-bed, there is nothing better than fresh stable manure. Horse manure is preferable, but in the absence of this, any fresh manure, being careful not to have it too "long," will do. As a final resort, cotton seed may be used. Fill twenty inches of the pit with this manure. Put it in in thin layers, wetting it thoroughly and packing it tight with the feet and a rammer of some kind. On top of this place six to eight inches of rich loam. For a cover, glass is preferable, but common white domestic, sewn into a sheet large enough to cover the bed well, will answer all purposes in this climate. Tack this to the boxing on the north side, and to a pole the length of the hot-bed on the south side, so it can be rolled out of the way. In a few days the heat of the manure will have raised the temperature of the soil sufficiently to plant. Have the surface of the bed fine and smooth, and plant the seed in drills about four inches apart and running north and south. Cover lightly, press down firmly, and water moderately.

A thermometer placed in the bed, near the soil, is a great aid in its management. Its temperature should be kept up to 70 degrees if possible. On bright, warm days, the cover should be rolled back, and in all but the coldest weather, one corner should be kept up for at least half the day in bright weather. Water frequently but sparingly. Watch the plants closely, giving slight cultivation by stirring between the rows with a short stick, or other implement. If the plants show signs of damping off, withhold water, and give all the ventilation possible, without exposing to too much cold. If the bed is late, and it is desired to hasten the plants, or they are growing too slowly, stir two or three handfuls of rotted manure into a bucket of water, and water with this two or three times a week. For forcing plants, there is nothing so good as a couple of tablespoonfuls of nitrate of soda dissolved in the water once or twice a week. Be sure to follow an application of liquid manure with a bucket of pure water so as to wash the leaves clean. As soon as the plants are large enough to handle (four to six leaves with tomatoes), they are ready for, and should be transplanted to, the cold frame.

COLD FRAME.

A cold-frame is very much like an enlarged hot-bed, provided with a cover of light cheese cloth, but not provided with artificial heat. Eight feet wide and thirty feet long, will give sufficient room to hold plants for an acre of tomatoes. The cold frame is generally built in the center of the field in which the plants are to be set. Set up 1x12 plank on edge all around the edge of the frame, letting it run north and south. Gable up the ends with 1x12 plank, making the gables about five feet high. Provide a ridge-pole for the center, supporting it by 1x4 rafters every four feet. The side plank should be kept from spreading by stakes driven into the ground outside the bed, and opposite the rafters. These latter should run from the ridge-pole to the top of the side plank. Provide a cover of cheese cloth sewn together large enough to cover the whole structure, and to lap well over ends and side plank. Tack it in the center to the ridge-pole, and to the edges tack light poles the length of the frame, so the cloth can be rolled up to the center. Spade the ground in the frame good and deep, work in a lot of well-rotted manure, and have fine and level. You are now ready for the plants. Tomatoes should be placed about four inches each way. Draw the plants from the hot-bed dry, by loosening the dirt with a trowel. Shake them free of dirt, and set one plant every four inches in the frame, making a hole with a stick, inserting the plant, and pressing the earth firmly around it. As soon as the plants are set, water the bed freely. The transplanting into the cold frame can be greatly facilitated by using the following described implement: A scantling, one by five inches, and long enough to reach across the bed, is bored with a line of one-inch holes, four inches apart, and with their centers four inches from one edge. Into these holes are driven inch pegs, four inches long, and sloping to a point. Wet the ground thoroughly, place this implement across the bed, pegs down, and with the wide edge next to the last row set, drive the pegs into the ground by pressing, or walking upon it, and when removed, you have holes for the plants clear across the bed. In bright, warm weather, roll up the cover during the daytime. As the plants approach the time for setting in the field, give more air, and for a week before setting, withhold water. On warm nights leave the cover up so as to harden them. The plants should not be placed in the field until all danger of frost is over.

These directions are especially for tomatoes, but will hold good with slight modifications, for all plants so delicate as to be injured by frost. Such plants as cabbage, onions and lettuce, do not need a hot-bed. The cold frame furnishes ample protection.



HOT-BED FULL OF PLANTS, WITH COVER ROLLED BACK, FEBRUARY, 1905. CALHOUN, LA.

PREPARATION, CULTIVATION AND FERTILIZING.

Than garden vegetables, there is no class of plants that respond more readily to good treatment. Select for their growing a light sandy loam soil that has grown a cover of peas the previous year, and, preferably, turn these peas under some two months before the land is needed. Plow deep, and pulverize thoroughly. All the well-rotted manure available should be worked into the land to be used for the growing of truck. As a general rule, cotton seed meal and acid phosphate will form the basis of all commercial fertilizers. To this might be added some potash in the form of kainit or sulphate. The proportions of these substances will vary with the plants to which they are applied. It should be remembered that cotton seed meal supplies nitrogen, and nitrogen tends to form leaf and stalk. With that class of truck crops in which the plant leaves are consumed, such as cabbage and lettuce, we should use relatively large quantities of this substance. On the other hand, phosphoric acid, supplied by the phosphate, tends to make fruit, and potash hardens and gives color to this fruit. Whatever the formula used, it must be borne in mind that truck crops are greedy feeders, and the best results are obtained by pandering to this trait. Six to eight hundred pounds of a mixture of two parts of meal to one of phosphate, is none too heavy for potatoes, whereas, cabbage will easily utilize fifteen hundred pounds (1000 of meal, 300 of phosphate, and 200 of kainit). These seem very large quantities, and the objection very often urged to their use, that the plants do not use all of this fertilizer, is very true. Yet, by adding these quantities a large amount of food is made available for the plant. What is left is more slowly soluble, and would not be of use to the plant, even if smaller quantities were used. Besides, this is not lost, as it will be utilized by the crop succeeding. It is the early vegetable that pays best. The difference of a few days in maturity very often places the balance on the wrong side of the ledger. These large quantities of fertilizer not only hasten the maturity, but are very beneficial on the quality, another very important consideration. The conditions of early maturity and tenderness emphasize the importance of thorough and rapid cultivation. This should be frequent, but shallow, so as to avoid any danger of root injury.

HARVESTING, PACKING AND SHIPPING.

As a rule the crop should be harvested just before it reaches maturity. The time for this depends somewhat upon the distance from the market and the method of shipment. Remember that it costs just as much freight for a package of poor goods as for the best, and while there is a market for good produce, poor stuff not only does not bring good prices, but reacts upon the superior article, reducing its price. It is, therefore, poor policy to ship inferior goods. Inspect and assort rigorously, retaining all doubtful product for canning, or to be otherwise disposed of. Better lose it entirely than send it to market to undermine the good. Learn what kind of package the market you are selling in prefers. Provide that package, and pack the goods securely and honestly. Be sure the package is full. Not only is this more honest, but your produce will arrive upon the market in better condition if this is done. Have the goods in each package as near the same size as possible, and as near the same degree of ripeness. Do not make the error of placing the best on top. Remember that every package is examined by the buyer until he learns whether you are honest or not, and this practice fools no one, and only serves to make the buyer wary of your goods. Pack neatly in a neat clean package. Nail it up securely, stencil your name and post office, and the name of the consignee upon it, and ship as promptly, and by the most direct route possible. Notify the consignee promptly of the shipment in order that he may know it is on the way, and have a chance to provide for its reception and disposal. The shipment of perishable goods by freight in refrigerated cars, is preferable. Very early in the season, ventilated cars may give satisfaction. Except with a few packages of very early vegetables or fruits, express shipments will not, as a rule, be found profitable. Not only will the charges be four or fivefold, but the packages are handled so often, and so roughly, that they invariably reach their destination in poor condition. Besides this, there is no assurance as to the temperature being kept low, and a low temperature, while in transit, is essential to the arrival of your produce upon the market in good condition.

Careful selection, packing and shipping cannot be too strongly urged. Upon the intelligence and care with which this is done, depends, largely, the success of the shipper. Remember that after leaving your hands, and before reaching the consumer, these perishable goods are subjected to their greatest ordeal, and too much care cannot be given to make this test as light as possible. A proper understanding of this by the shipper would save many a disappointment, and many a hard word for the consignee.

DISPOSING OF THE GOODS.

Of course, all else being equal, it is much safer and more satisfactory to sell on the track. However, this is not always possible, nor is it always advisable when possible. It would be unjust to demand or to expect the buyer to pay you the net price of the Chicago market for your goods at your home town.

In buying from you there, he takes the risk of transportation, of the fluctuations of the market and pays all selling charges, and it is but just and right that he should be allowed a fair margin for these risks. On the other hand, human nature is the same the world over, and unless you watch Mr. Buyer closely, you will find he shows a decided tendency to make this margin unnecessarily large. To sell on track, intelligently and advantageously, therefore, you must make a close study of the market conditions. It is not enough to know what stuff sold for last week. You should know what it sold for the day before, and what the conditions of supply and demand are. Is the crop a large one? Is the movement to your market large or light? Is the demand brisk or dull? Is your railroad service efficient? All these questions should be considered, and unless the farmer recognizes that the disposal of his crop is a business, and adopts business methods, he is sure to come to grief.

In order to do this, it is necesary to have some reliable source of information. For this purpose, select some reliable commission house, and if necessary, pay them to furnish you daily market reports by wire during the shipping season. Do not begrudge the little money these telegrams will cost, for they will frequently save you many a dollar, even on one carload.

There is another point upon which we wish to lay special emphasis. In engaging in truck-growing, do not fall into the one-crop system. Plant a variety. There can be made no greater error than that of placing your sole dependence in one crop. No produce is subject to greater fluctuations in value than that of the market-gardener, and many an embryo-trucker has been so disappointed by the results obtained when only one crop was planted, that he ever after is irritated at the mention of truck growing.

WHAT CROPS TO RECOMMEND.

Most any vegetable if placed upon the market early, and in good condition, will sell well, but it is best not to attempt too many varieties at first.

To the beginner, we would suggest that he plant half an acre in cabbage, half an acre in onions, one or two acres in potatoes, half an acre in beans, half an acre in tomatoes, and half an acre in Rocky Ford melons. This list will give him a good variety of experience, and is as much as he should attempt the first season. Do not make the fatal mistake of over-cropping. Remember that truck crops take, relatively, a large amount of labor, will not await the convenience of the farmer for cultivation, and must be gathered at the right time.

A few suggestions as to the planting, cultivation, and handling of these would not be amiss, in the order in which they should receive attention.

CABBAGE.

Cabbage is the first crop. The variety that has given the best general results is the Charleston Wakefield. The seed should be sown thinly in December, or early in January, in a cold-frame. A frame, five by twenty feet, should give ample plants for an acre. Provide a light cheese cloth to protect the plants in the coldest weather. They should be ready for the field by the middle of February. Plow the land well and deep, and have in fine condition. Lay off the rows three and one-half feet apart. If commercial fertilizer is used, apply half in the drill, and list upon it with two light furrows. Then put the remainder in the two side furrows and break out the middles shallow. Set plants from two and one-half to three feet in the drill. If it is dry, punch holes with a stick, fill with water, insert the plants,

AN ACRE OF TOMATOES AT CALHOUN EXPERIMENT STATION.
MAY 20, 1904.

FIELD OF CABBAGE AT ROSELAND, LA.

and press dry earth around them. As soon as the plants have started growing stir the ground around them, and give clean frequent cultivation. If troubled with flea-beetle, dust the plants with air-slacked lime. Cut-worms can be held in check by placing a small quantity of poisoned bran between the hills. If troubled with cabbage worms, or other worms, do not hesitate to use Paris green dusted lightly on the plants. When headed good and hard, they are ready for shipment.

Cabbage are best shipped in crates, weighing when full, from 175 to 200 pounds. They are made of 1x3 dry stuff, using three slats to a side, the finished crate measuring 15x15x30 inches. Take the ready made crates to the field. With a sharp knife cut the head from the stalk, close up. Remove all but two or three loose leaves, and pack in the crate lightly, pressing them in. Fill over full and press top slats down with the knees, and nail securely. Mark your name on the side, and the name of the shipper and the weight, on the end, and ship promptly in ventilated or stock cars.

ONIONS.

There are two methods of proceeding with onions. Either raising them from seed, or putting out sets. If it pays the other fellow to raise the sets and sell them to us, we had as well make that profit and plant the seed ourselves. For this purpose, the seed (Red Wethersfield is our choice) should be sown in the cold-frame by the 15th of December. Very slight protection is needed even in the coldest weather, unless they are growing very rapidly.

Prepare the ground as for cabbage, using from 1000 to 1,500 pounds of the same fertilizer, and applying it in the same way. Set the plants 4 inches apart in from three to three and one-half foot rows. For hand culture the rows may be one foot apart. Give about the same cultivation as cabbage. When ripe, lift from the ground, remove the roots and tops, and pack for shipment in clean two-bushel sacks. Sew the sacks securely, leaving projecting ears for handling. Mark your name or initials, the consignee's name, and the weight, upon the sack, and ship in ventilated or stock cars.

TOMATOES.

Tomatoes are by far the most difficult crop for the novice to handle, and yet, when properly handled, will probably give him the largest returns. They should be sown in the hot-bed from the 20th of December to the 10th of January. The Acme or the Beauty is about as good a selection as can be made. The directions for the management of the hot-bed and cold-frame, are applicable to the tomato, so it is needless to repeat them. The plants should be ready to go to the field as soon as the danger of frost is over. This should be safe by the 20th of March to the 1st of April. Do not risk a frost by trying to get the plants into the field too early. They will be injured less by crowding in the cold-frame than by frost. Have the land well prepared, and lay it off in four-foot rows. Apply the fertilizer as with the previous plants, using 500 pounds cotton seed meal, 300 pounds acid phosphate and 200 pounds kainit. Open the rows with a small scooter. Wet the soil in the cold-frame until saturated. Remove a four-inch block of earth, in which the plant is setting, to a depth of four inches, with a small trowel. Set the plants and adhering dirt on a slide, or hand-barrow. When taken to the field on this slide, or barrow, set a plant with its adhering dirt every three feet in the previously opened furrows. Throw two light furrows back upon this, and the setting is done. As with cabbage, cultivation should be clean and frequent, but very shallow. As soon as the plants show a disposition to fall over, they should be staked and tied. The stakes used for this purpose are light 1x1 strips three feet long, and are generally split from pine. Drive one down firmly by each plant, on the side opposite the bloom, and tie the plant, with ordinary cotton twine, just under the fruit bud, to this stake. Be careful not to tie it tight; let it have room to grow, and not be cut by the twine. The plants will now begin to send out suckers, or branches, from the axil of each leaf. These should be carefully removed every day or so, and no branching allowed. There is no danger of confounding the sucker with the fruit branch. The former starts where the leaf joins the stalk, just above the junction; whereas, the latter starts from the stalk on the side opossite the leaf. Repeat the suckering and tying whenever necessary. Plants will ordinarily require about three tyings. In tying, be careful to twist the fruit bud away from the stake, so the fruit will not rub against the stake and be damaged. When the plants have set from four to five fruit buds, pinch out the end bud. This is done to check the growth of the plant, thus forcing all the strength into the fruit already set. As a result, this fruit will reach a greater size, and will ripen earlier.

Damp, murky weather is favorable for the rot. It is, therefore, not a bad idea to spray as soon as the fruit forms, with Bordeaux mixture, in which is stirred a little Paris green. If this is done, it should be after each fruit bud appears, to obtain full results.

The rot is not a frequent visitor, however, and the chances of its appearance may be taken. As soon as the fruit shows the first blush of red around the blossom end, it is ripe enough for shipment. Do not ship before, as it will not ripen evenly. The fruit should be gathered in baskets holding not over a bushel, brought to the packing shed, and spread upon a table. The four basket, or the one-third bushel crate, is the approved package for tomatoes. These we bought last year for 7½ cents, f. o. b. Calhoun. Pack the fruit in the baskets, laying them evenly, and pressing them in tight. Select as near the same size and degree of ripeness for each basket and crate. Discard all misshapen or injured fruit. Pack nothing that is not perfect. If the tomatoes are large, make two layers, laying them flatwise, and filling up any remaining room with a single small fruit. Pack them tightly, but be careful not to bruise. In packing medium-sized fruit, put the bottom layer in on edge, filling in the top with a flat layer. With smaller fruit, both layers are ''rolled'' or packed edgewise. In doing this, make a row all around the edge of the basket first, being careful to place the blossom end out, then fill in as evenly as possible, observing the same rule in regard to the blossom. The baskets should be so filled that when the tops are nailed on, they will press the fruit down firmly, but not hard enough to bruise. As soon as packed, put in a cool place, and ship as soon as possible. The refrigerated car is the only satisfactory way to ship tomatoes.

A car will hold from 600 to 800 crates. The icing charge, when divided among this number, amounts to very little, and will be more than returned in the better prices realized.

In packing tomatoes or fruit in a car, the crates should be laid carefully in rows, and a couple of 1x1 strips placed at least between every other layer for better ventilation. If the car is not filled from end to end, the end of the tiers should be well braced. A stout strip should also be laid across the top of each row of crates, and braced from the roof. Any one who has ever traveled on a freight train will realize the necessity for these precautions.

POTATOES.

The Triumph is the potato the market wants, hence, is the potato to plant. Ground for potatoes should be broken good and deep not later than the middle of January. Re-brake from the 20th of February to the 10th of March; bed the land in four-foot rows, and plant about March 10th. The fertilizer, consisting of 800 to 1,000 pounds, composed of 3 parts cotton seed meal, 2 of acid phosphate, and 1 of kainit, should be applied as for the other vegetables above. Avoid the use of much stable manure for potatoes, for, while it will give large yields, the fruit is apt to be scabby, and will not sell well. Cut the potatoes to two good eyes, and drop the pieces about 16 inches in the drill. Cover lightly, and cultivate well. If troubled with potato beetle, poison with Paris green. One or two light applications will put him out of business. Do not dig before the potato is ripe, or they will rot in transit. This stage may be known by the vines beginning to turn yellow and dying. Do not dig when the soil is too wet, or you will have dirty potatoes. Assort as soon as dug, throwing all potatoes less in size than a hen-egg into the culls. Here place, also, all sunburned, bruised, cut, or skinned potatoes. Do not let the sun shine on them for any longer time than necessary, for it will scald them, and cause them to rot. Handle the crop carefully, and as little as possible, in order not to bruise or skin them.

Potatoes are shipped in two kinds of packages. Clean flour barrels, ventilated at the sides and ends, or a sack holding about 90 pounds, or one and one-half bushels. The sack being cheaper, is preferable. Save the cotton seed meal sacks for this purpose, but wash them clean before using. If possible, sack, or barrel them right in the field, being careful to have the barrels full and well shaken down. Sew the sacks tightly and neatly with strong twine, rolling the surplus sacking inside, and leaving good projecting ears for handling. Mark the weight, the initials of consignee and your own on the sack. In loading, start at one end of the car and stand the sacks up close to each other and to the end, making a row across the car. Break joints with the next row, keeping the sacks pushed up close. Fill to the door this way, then start at the other end. Nail a stout scantling across each door, so as to keep the sacks in. One layer of sacks on end, and one layer laying down on top of these, is all that should be loaded in a car. Loaded in this way, a car will hold from 400 to 450 bushels.

BEANS.

Three varieties, Improved Valentine, Kidney Wax, and Dwarf Lima, may be planted. As with other vegetables the ground should be well prepared. The rows should be 3 1-2 feet apart, and the beans drilled about 2 inches apart, between the 20th of March and the 1st of April. The bean differs in its fertilizer requirements from all the other vegetables above mentioned, in that it belongs to the great nitrogen-gathering family of Legumes and hence, requires very little nitrogenous fertilizer. Some small quantity is beneficial, however, in that it starts them off more rapidly. As a fertilizer, we would recommend 2 parts of acid phosphate, 1 part of cotton seed meal, and 1 part of kainit. Beans should be gathered as soon as well filled, and before they get tough and hard. Ship in the bushel hamper basket. Lay them in straight, shaking well, as filled, and heap them up before pressing on and fastening the cover. Ship in ventilated, or, preferably, refrigerated cars.

CANTELOUPES.

The Rocky Ford melon has a reputation on the market that none can equal, and, hence, it is the melon to plant.

Prepare the land thoroughly in five-foot beds. Use all the well-rotted stable manure available, working it well in, and bedding-on a good quantity. Apply in the drill 600 to 800 pounds of a fertilizer composed of 3 parts cotton seed meal, 2 parts acid phosphate, and 1 part kainit. From the 1st to the 10th of April, plant in hills, 4 to 5 feet apart in the row, and cover lightly. If troubled with insects, powder with air-slacked lime, containing a small quantity of Paris green. Cultivate clean and rapidly, and commence shipping as soon as they begin to turn. Do not ship a green melon. Canteloupes are shipped in barrels, or, preferably, crates, weighing when full about 80 pounds. They are best shipped in refrigerated cars.

REMARKS.

Doubtless, a good deal of the above will seem superfluous to many. Our reason for going so minutely into detail is the fact that truck-raising and shipping is a business of detail, and one in which a lack of knowledge of detail receives a sure and swift punishment. It is not expected that this will be of much, or any, value to the experienced grower. It can be of very great value to the novice. The suggestions are from knowledge gained by actual experience, and from a careful study of the best methods used by experienced growers elsewhere, and from observations made, in person, upon the markets in which the produce is sold.

The one great suggestion that these observations sound in most emphatic terms is, the necessity for co-operation. To ship in carloads requires considerable acreage, and more time and labor than can well be given by any one farmer. It is only possible by co-operating with his neighbor, and this brings about organization into associations. The selling of the product is almost a distinct business, and, in order that it may be intelligently done, there should be someone whose special business it is. The first step to succeed, then, in truck-growing, is to get your neighbor interested, and the organization of a Fruit and Truck Association. Select for your officers men of good business ability, who can and will give their time to the business, and in whom you have confidence. If means will permit, and you can get him, it is good economy to employ the services of an experienced shipper as director and instructor for the first season. While the growing of truck is, and can be made remunerative, and the Station recommends it wherever the transportation facilities will permit, yet it wishes to warn all, lest they be disappointed, that the big results you read about are not to be expected every day, and especially by a beginner. Yet even the beginner, if he goes into the business conservatively, and with the determination to succeed, should find it quite profitable.

QUANTITIES OF SEED NECESSARY TO PLANT AN ACRE.

Beans, in drills, 2 bushels per acre.
Beets, in drills, 5 pounds per acre.
Cabbage, sown in bed, 1-4 pound per acre.
Cucumber, in hills, 2 pounds per acre.
Lettuce, seed sown in beds, 1-2 pound per acre.
Musk melon, in hills, 2 pounds per acre.
Water melon, in hills, 4 pounds per acre.
Onions, seed sown in beds, 1 pound per acre.
Onions, seed sown in field, 5 pounds per acre.
Onions, sets, 8 to 10 bushels per acre.
Peas, 1 1-2 bushels per acre.
Potatoes, 6 bushels per acre.
Radishes, in drills, 8 pounds per acre.
Squash, in hills, 2 pounds per acre.
Tomatoes, seed sown in beds, 1-4 pound per acre.

NOTE ON FERTILIZERS.

While all experiments conducted in Louisiana indicate that no potash is required for farm crops, and that it is of doubtful utility in increasing the yield of truck crops, in order to be sure that an abundance of food is supplied in easily available form when growth is forced, and from the general conviction among experienced truckers that potash adds some desirable characters to the products, such as firmness in berries, we have recommended a moderate use of potash. Muriate of potash is preferable to kainit, as it has about four times the per cent of potash found in kainit, so there is less freight to pay on useless, if not worse than useless matter.

It will be noticed that there is a difference in the proportions of the ingredients of the fertilizers recommended and those actually used. These recommendations are made after a careful comparison of the results of a series of years and are considered better than the proportions used during 1904.

THE GARDEN.

By E. J. Watson, Horticulturist.

The character of work previously carried on in the vegetable garden was modified the past season and trucking experiments on a larger scale were undertaken. These experiments, with a few unimportant exceptions, were successfully carried out, and much valuable experience and information secured that will be of great benefit in future operations along this line.

The leading crop in these experiments was

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TOMATOES.

The seed were planted in the hot-bed January 19th. The planting should have been earlier, but there was an unavoidable delay in getting the seed. The varieties used were Acme and Beauty. The planting covered seven-eighths of an acre. On March 1st the plants were transferred to the cold-frame, and again, on April 1st, to the field. They were set 3 feet in the drill and in 3 1-2 feet rows. Six hundred pounds of fertilizer, consisting of two-thirds cotton seed meal and one-third acid phosphat, per acre, was applied in the drill. This was supplemented with 50 pounds of nitrate of soda, applied after the plants had commenced growth. The plants were tied to stakes and trained to a single stem, all suckers being rubbed off as they appeared. An average of from four to six fruit bunches were allowed to the plant.

The crop set was enormous. Express shipments began on June 8th, but about this time the rot appeared and two-thirds of the crop was destroyed, only the bottom crop remained for the early shipments. Later the top crop afforded several light shipments, but prices were then low.

Two hundred and thirty-six crates were shipped, besides 20 bushels, or about 60 crates, were canned. These brought an average of 50 cents per crate, net. The quality of the fruit and the packing were pronounced by experts as up to the market standard.

In view of the fact that the fungus causing the rot is easily preventable by the judicious use of Bordeaux mixture, it will readily be seen that from four to five hundred crates of fruit could have been shipped from the seven-eighths of an acre. But we had not anticipated the rot, as it had not previously given any trouble in tomato growing here for the past twelve years, and consequently we were not prepared to deal with it. The coming season, however, will find us prepared.

By keeping a very strict account the total cost of producing an acre of tomatoes from seed-bed to market, was found to be in round numbers $50.00 per acre. This was based on labor at $1.00 per day, which is probably too high. Where spraying is done this would not be too high, and the proceeds should be correspondingly greater.

POTATOES.

One-half of an acre of potatoes was planted February 15th. Only the Bliss Triumph variety being used. Four hundred pounds of commericial fertilizer, consisting of equal parts of cotton seed meal and acid phosphate, was used per acre. The weather conditions during April and May were very unfavorable for the development of the tubers, and consequently the yield was so light that from a commercial standpoint the crop was a failure. Such unfavorable conditions may not, and probably will not prevail again for many years. The yields of previous years at this Station indicate that the yield of potatoes of any average year are such as to bring remunerative returns, when sold at anything like a fair price.

CABBAGE.

This crop was very successful and good prices were secured. Only one-eighth of an acre, however, was grown. The seed was planted in cold-frame February 1st and transplanted to the field March 7th. One thousand pounds of commercial fertilizer, consisting of 600 pounds cotton seed meal and 400 pounds acid phosphat, was used per acre. The yield was 16 crates for the eighth of an acre, weighing 175 pounds per crate, or 128 crates per acre. A small shipment was made to Cincinnati, and they brought $2.50 per crate. This shipment was per express and no profit was realized on the shipment, but in car lots, by freight, the net returns should have been not less than $2.00 per crate. It was difficult to figure the cost of production per acre on so small an acreage, but from an account of the labor expended on the plat (one-eighth of an acre), it would amount to about $5.00, or $40.00 per acre, which at the yield and figures secured, would leave a very handsome profit. We expect to grow a larger acreage in cabbage the coming season. The variety used the past season was the large, or Charleston Wakefield, which we believe to be admirably adapted to the early market crop.

BEANS.

Only one-fourth of an acre was planted in snap beans—the Early Mohawk variety being used, which did not prove suitable for the market (Cincinnati) to which they were sent, a wax bean being wanted. They were planted March 22d, and the weather afterwards proved very unfavorable, which reduced the quality and yield. Four hundred pounds of commercial fertilizer, per acre, consiting of equal parts cotton seed meal and acid phosphate, was used in the drill. Shipments began May 15th, which was very late, but cold weather held the crop back. The total yield of green beans on the plat (one-fourth of an acre), was 18 bushels, or 72 bushels per acre. During a favorable season the yield would be much greater. The prices received averaged 50 cents per bushel, net. The cost of the labor was estimated to be about $20.00 per acre, including cost of seed and fertilizer.

RADISHES.

A small quantity (one-eighth of an acre) of radishes was planted February 15th, but, as with the beans, cold weather prevented the quick and full development of the crop, consequently they were not in time for the market. The total yield was 820 bunches, 6 to 10 radishes per bunch, for the plat (one-eighth of an acre), or 6,560 bunches per acre. No sales were made, but they were worth about 30 cents per dozen bunches, net. The variety grown was the Long Scarlet. The French Breakfast would have been more suitable for the purpose. It is of quicker growth and in greater demand.

BUSH LIMA BEANS.

A small planting (one-fourth of an acre) of Henderson's Bush Lima Beans was made March 22d. The fertilization and cultivation being the same as for the snap beans. The results were not satisfactory and a second planting was made the first of June, which did splendidly, giving a yield of 24 bushels of dry beans (shelled) per acre, worth $2.00 per bushel, net.

CUCUMBERS.

On April 9th a planting of cucumbers (one-eighth of an acre) was made, consisting of one row each of the following varieties, all from home-raised seed: Early Green Cluster, Long Green Turkey, White Spined, New Orleans Market, Fordhook Famous. These were planted in rows 5 feet apart and 5 feet apart in the drill. Eight hundred pounds of commercial fertilizer per acre was used, being equal parts of cotton seed meal and acid phosphate. The yield was obtained by securing the number of bushels of "cukes" of marketable size. The yields of the different varieties being as follows: Early Green Cluster, 80 bushels per acre; Long Green Turkey, 82; White Spined, 72; New Orleans Market, 76; Fordhook Famous, 64. No sales were made and the market price per bushel was not obtained.

CANTALOUPES.

One-half acre was planted in cantaloupes April 4th, consisting of the following varieties (one row each), all from home-raised seed: Netted Nutmeg, Rocky Ford, Long Island Beauty, Golden Netted Gem, New Orleans Market, Baltimore or Acme, Osage, Delmonico, Acme-Arundel, Banana Citron. These were planted in rows 6 feet wide and the hills 6 feet apart in the drill. They were fertilized with stable manure, at the rate of 100 bushels per acre applied in the drill. The earliest varieties to ripen were Netted Nutmeg and Rocky Ford, June 30th, followed by Golden Netted Gem, July 3d. The yield per acre in bushel crates from each variety was as follows: Netted Nutmeg, 30 crates; Rocky Ford, 46; Long Island Beauty, 34; Golden Netted Gem, 45; New Orleans Market, 38; Baltimore or Acme, 42; Osage, 32; Delmonico, 35; Acme-Arundel, 44; Banana Citron, 22. Only one small shipment was made, on July 5th, the average price being $1.25 per bushel, net. The yield was far below the average of previous seasons on the Station, mainly on account of excessive rainfall during the fruitng period. The quality of the crop was good.

The labor expended on the one-half acre footed up in round numbers $15.00, or $30.00 per acre, on a basis of $1.00 per day for labor, including cost of seed, crates, fertilizer, etc.

WATER MELONS.

Three-quarters of an acre in water melons were grown, consisting of one row each of the following varieties: Ice Cream, Carolina Bradford, Jordan's Gray, Pride of Georgia, Kolb Gem, Rattlesnake, Triumph, Jones, Lone Star, Eden, Halbert Honey. All these except the last named were of home-raised seed. One row each of these was planted, besides one-third acre in Kolb Gen alone. The planting was made April 20th. The rows were 10 feet apart and the hills 10 feet in the drill. The land was prepared and fertilized the same as for cantaloupes. The varieties began ripening July 1st, Jordan's Gray being the first to ripen. The yields were estimated from the average number of salable melons per hill, which was from 3 to 5. The yields per acre were as follows: Ice Cream, 652 melons; Carolina Bradford, 956; Jordan's Gray, 985; Pride of Georgia, 874; Kolb Gem alone. The planting was made April 20th. The rows were Star, 540; Eden, 625; Halbert Honey, 542. These yields are far below the average of previous years at the Station. No sales were made, but melons were selling at the time on the Cincinnati market for about $10.00 per 100. The estimated cost of production, per acre, was in round numbers $20.00.

The melons were of good size, averaging 24 pounds per melon, and the quality was excellent, particularly of Carolina Bradford, Pride of Georgia, Kolb Gem and Triumph.

SQUASHES.

One-quarter of an acre in squashes was planted April 18th, consisting of two varieties: Early White Bush and Summer Crookneck. Preparation, cultivation and fertilization same as for cucumbers.

A small shipment was made June 25th, netting 75 cents per bushel crate for the Early Bush—the Crookneck was not shipped. The yield per acre was 70 bushels for the Early Bush and 66 for the Crookneck.

The cost of production footed about $20.00 per acre.

OKRA.

On April 18th one-eighth of an acre was planted in okra, of the following varieties of home-raised seed: Dwarf Green Prolific, French Market, White Velvet. Four hundred pounds of commercial fertilizer was used per acre, and the preparation and cultivation were very much the same as that ordinarily given cotton. No shipments were made of the crop, but a considerable quantity was very successfully canned, which proved to be of highly satisfactory quality.

By keeping the mature pods pulled off the crop lasted through the entire season until frost.

The average yield for the season was estimated to be 60 bushels per acre. No prices on the fresh product were obtained.

BUSH BEANS.

Fifteen varieties of bush beans were planted March 24th, as follows: Dwarf German Wax, Early Mohawk, Best of All, Improved Valentine, Extra Early Refugee, Early Yellow Six Weeks, Davis' Kidney Wax, Wardell's Kidney Wax, Perfection Wax, Red Kidney Wax, Detroit Wax, Stringless Green Pod, Currie's Rust-Proof Wax, Early Refugee Wax, Keeney's Rustless Golden Wax. Owing to unfavorable weather these did not develop fully. Yet the crop as a whole was good and the success of home-grown seed was fully demonstrated, although the varieties were badly mixed from being grown together for several years continuously.

The yields per acre in bushels were not obtained, as only a small space was devoted to each variety. The yields on a scale of 10, stood as follows: Dwarf German Wax, 7; Early Mohawk, 8; Best of All, 6; Improved Valentine, 9; Extra Early Refugee, 6; Early Yellow Six Weeks, 5; Davis' Kidney Wax, 8; Wardell's Kidney Wax, 8; Perfection Wax, 7; Red Kidney, 4; Detroit Wax, 7; Stringless Green Pod, 9; Currie's Rust-Proof Wax, 10; Early Refugee Wax, 6; Keeney's Rustless Golden Wax, 8. A good selection for either home use or market is Dwarf German Wax, Improved Valentine, Davis' Kidney Wax, Stringless Green Pod, Currie's Rust-Proof Wax. Early Mohawk is extensively used for the very early crop on account of its hardiness, but it cannot be grown in this locality very early, and at the same time secure a good yield and good quality.

PEAS.

The following varieties of peas were planted January 19th: First and Best, Saxton's Alpha, White Marrowfat, Black Marrowfat, Champion of England, Dwarf Telephone, Telephone, Tall Sugar. These were all from home-raised seed. It was not intended to plant the crop for commercial purposes, consequently only a small area was planted, but the crop proved to be so successful that a small shipment was made May 5th. They sold for 50 cents per bushel, net. The early varieties, First and Best, and Saxton's Alpha, produced a very heavy crop, but were over before any were placed on the market. Those shipped were from the Marrowfats. The yields on a scale of 10, were as follows: First and Best, 10; Saxton's Alpha, 10; White Marrowfat, 9; Black Marrowfat, 9; Champion of England, 7; Dwarf Telephone, 6; Telephone, 6; Tall Sugar, 7.

ONIONS.

At the beginning of the year it was not contemplated that any onions should be grown as a truck crop, consequently only a small area was planted in sets of the Red Weathersfield, early in January, for table use. They were heavily fertilized with stable manure and later with cotton seed meal, at the rate of 500 pounds per acre. The crop was highly successful, producing at the rate of 86 bushels per acre. No special effort was made to produce a commercial crop. Onions were selling at the time, $1.50 per bushel.

TOMATOES—VARIETIES.

Thirteen varieties of tomatoes from home-raised seed were planted in hot-bed February 23d and transferred to cold-frame April 15, and later to the field, May 10th. The varieties are as follows: Acme (home seed), Acme (northern grown), Early Jewell (northern grown), Early Jewell (northern grown seed), Beauty (home seed), Beauty (northern grown seed), Ponderosa, Favorite, Perfection, Large Yellow, Paragon, Honor Bright, Stone, Extra Early Dwarf Red.

The crop produced was good, both as to quantity and quality, but owing to the small area devoted to each variety the yields in bushels per acre was not obtained. Several duplicate experiments of home-raised and northern grown seed were conducted, but the difference in the results was very small.

The results on a scale of 10, were as follows: Acme (home seed), 8; Acme (northern seed), 8; Early Jewell (home seed), 9; Early Jewell (northern seed), 8; Beauty (home seed), 8; Beauty (northern seed), 8; Ponderosa, 6; Favorite, 5; Perfection, 6; Large Yellow, 4; Paragon, 7; Honor Bright, 7; Stone, 9; Extra Early Dwarf Red, 8.

The Early Jewell (Chalk's Early Jewell), which is sent out by Burpee, and tried here for the first time last season, proved again to be a magnificent variety.

The following new varieties were sent by W. A. Burpee & Co., for trial:

Crimson Giant Globe Radish: Appears to be a good variety.

Danish Round Head Cabbage: Proved very satisfactory; heads small, solid, uniform.

Early Model Beet: Early and good.

Nameless Black Red Beet: Later than the above; good size and quality.

Butterhead Lettuce: Unsatisfactory; heads soft and open.

Express Company's Lettuce: Appears to be good.

New Brittle Ice Lettuce: Very fine and solid, crisp.

Clark's Early Jewell Tomato: A decided acquisition.

Spark's Earliana Tomato: Early, but otherwise ordinary.

"Prolific" Pea: One of the earliest tested.

Senator Pea: Pods very large and well filled, but did not produce abundantly.

English Wonder Pea: A new dwarf variety; promising.

British Wonder Pea: Similar to the preceding.

Halbert Honey Water Melon: Of small to medium, oblong, dark green; flesh deep red, sweet; in all respects a good melon for home use; too small for market.

Fordhook Famous Cucumber: No doubt a valuable acquisition.

TABLE SHOWING RESULTS OF THE MOST PROMISING AND SUCCESSFUL VARIETIES OF PEACHES OF THE PAST SEASON (1904).

VARIETY.	Date of Blooming.	Date of Ripeing.	Class.*	Number of Crates (⅓ bu.) Per Acre (Estimated.)	Value of Crop, Per Acre, (Estimated.)	REMARKS, ETC.
Alton	March 8	June 6	f	436	$218	A white peach, large size, good.
Alexander	March 10	May 20	f	436	218	A well known variety.
Amelia	March 6	June 24	f	109	55	A large size, good peach.
Berenice	March 3	June 30	f	436	218	One of the best for general purposes
Berckman's	March 6	June 28	f	545	272	A very heavy and regular bearer.
Bequett Free	March 8	July 1	f	218	109	A large white peach, very good.
Bokara No. 3	March 3	June 20	f	436	218	A heavy and regular bearer.
Carman	March 3	June 6	f	109	55	A very large and attractive peach.
Carpenter's	March 8	July 5	c	327	163	A handsome peach of good qualities
Champion	March 3	June 23	f	109	55	A very good peach.
Crawford Early	March 3	June 28	f	436	218	Bears irregular.
Crawford Late	March 3	July 10	f	218	109	Bears irregular.
Columbia	March 8	July 16	f	327	163	A good peach of the Spanish type.
Crosby's	March 3	July 12	f	109	55	A very shy bearer.
Early Beatrice	March 18	May 20	f	218	109	Fruit of small size, good quality.
Early Louise	March 12	May 30	f	218	109	Larger than the preceding.
Early Rivers	March 9	June 5	f	218	109	A large white peach, good.
Early Tillotson	March 3	June 15	f	436	218	One of the best.
Elberta	March 3	July 1	f	436	327	Size and quality fine.
Galveston	March 3	May 26	f	654	327	A medium size, white peach.
Gen. Lee	March 8	July 1	c	109	55	Very large, white.
Georgia Cling	March 8	July 10	c	327	163	A good peach for home use.
Greensboro	March 8	May 25	f	436	210	A good variety.
Grand Admiral	March 8	July 6	c	218	109	Name obscure, has not been verified.
Juno	March 6	Aug. 1	c	218	109	A yellow cling, good.
Lady Ingold	March 6	June 24	f	436	218	A very attractive yellow peach.
Lulu	March 3	July 20	f	109	55	A yellow peach of the Spanish type.
Mamie Ross	March 1	June 6	f	436	218	A leading variety.
Miss Lola	March 8	June 8	f	109	55	A good white peach.
Mountain Rose	March 3	June 25	f	545	272	One of the best.

TABLE SHOWING RESULTS OF THE MOST PROMISING AND SUCCESSFUL VARIETIES OF PEACHES OF THE PAST SEASON (1904)—CONTINUED.

VARIETY.	Date of Blooming.	Date of Ripening.	Class.*	Number of Crates (⅓ bu.) Per Acre (Estimated)	Value of Crop, Per Acre. (Estimated.)	REMARKS, ETC.
New Prolific	March 8	June 28	f	327	$163	Small size, yellow.
Old Mixon Free	March 6	July 6	f	654	327	Well known.
Old Mixon Cling	March 6	July 10	c	218	109	Good for home use only.
Onderdonk	March 6	July 20	f	218	109	A good yellow peach. Spanish type.
Oriole	March 6	July 10	c	545	272	One of the best for home use.
Pallas	March 3	June 25	f	218	109	A good variety of the honey type.
Plant	March 6	July 5	c	218	109	A very attractive yellow cling.
Reeves' Favorite	March 6	June 30	f	109	55	A very good yellow peach.
Sea Eagle	March 8	July 8	f	218	109	A medium size white peach.
Smock Free	March 8	July 22	f	327	163	A good yellow peach.
Sneed	March 6	May 12	f	109	55	The earliest on the list.
Stump the World	March 8	July 5	f	327	163	Good only for home use.
Thurber	March 6	June 28	f	872	436	The largest yield for the season.
Triumph	March 8	May 30	f	327	163	A good early yellow peach.
Wonderful	March 8	July 22	f	327	163	A good yellow peach.
Victoria	March 3	July 15	f	109	55	A large size yellow peach.
Yellow St. John	March 3	June 15	f	327	163	A well known market sort.
Woddell	March 3	June 20	f	327	163	A good peach.

*F—Free stone. C—Cling stone.

The above constitutes a good list to select from, for any purpose desired. The cream of the list is about as follows: Alton, Alexander, Berenice, Berckman's, Carman, Early Tillotson, Elberta, Galveston, Greensboro, Mamie Ross, Mountain Rose, Old Mixon Free, Oriole, Sneed, Smock Free, Thurber, Triumph, Woddell.

Those given below have been found undesirable: Summer Snow, Gold Dust, Chair's Choice, Salway, Fitzgerald, Imperial, Cobler's Indian, Lemon Cling, Climax, Colon, Angel, Gov. Briggs, Florida Gem, Bidwell's Late, Bidwell's Early, Albright's Winter, Emma, Stenson's October, Waldo, Everbearing, Heath's Late White, Deming's September, Klondyke, Eaton's Gold, Susquehanna, Chinese Cling, Texas, Early Cream, Rupley's, Maggie Burt, Early China.

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PLUMS.

Some very satisfactory results have been obtained from the plums the past season, but confined to only a few varieties. The majority of the trees have lately been dug out and burned, as many had died during the season and nearly all showed signs of being diseased. Very successful results were obtained from the Abundance variety, which bore a very large crop. Several crates were shipped to Cincinnati which topped the market, bringing $2.00 per crate. Other varieties, viz.: Milton, Chabot, Poole's Pride, and Cumberland, did well.

APPLES.

For several years past extensive tests of all the many commercial varieties of apples have been made, but without any decidedly promising results. The following summer varieties are successful and their culture could possibly be made profitable: Yellow May, Red Astrachan, Red June, Early Harvest. Our future work with apples will be principally along the line of developing kinds peculiarly adapted to this climate.

PEARS.

The pear orchard continues promising; the trees are all in a healthy and vigorous condition. A very large crop was obtained from Leconte the past season, the Kieffer also bore heavily. The Bartlett is also very promising. The Magnolia, a new variety, is also doing well.

STRAWBERRIES.

Variety tests of strawberries were continued the past season, but will hereafter be discontinued and the work in this line devoted to fertilizer tests, and demonstrations in commercial growing and shipping, and for this purpose one-half acre was set out during November, the variety being used being Lady Thompson.

FIGS.

The Celestial, or Celeste, continues to give excellent results. The Brown Turkey also does well. Madeline has at times given good crops, but is too tender for this climate. The other kinds that have been grown here are too tender.

COMMERCIAL ORCHARD.

One acre of peaches, consisting of Sneed, Mamie Ross and Elberta, has recently been set out, the object being a demonstration in commercial peach growing. Fertilizer tests will also be made with this orchard. Twenty plum trees, of the Abundance variety, were also set out.

THE CANNING BUSINESS.

E. J. Watson.

A question of very considerable economic importance to the farmers of the State is that of utilizing to the best advantage and profit the surplus, or otherwise waste products of the farm, such as fruits and vegetables.

To can these, for home consumption and market; to raise a supply for these special purposes, and to eventually build up a home canning industry, is one of the most promising additions farmers can engage in.

To gain reliable data, to encourage work in this line and to disseminate information, the Station inaugurated demonstration work in this line on a small scale the past season.

To build and operate a canning business on large commercial basis belongs to the domain of the expert with ample capital; but fortunately, there are means and methods by which any small farmer, or enterprising individual, whether farmer or not, can very successfully build up a canning business for himself, provided he will go about it intelligently.

The outfit the Station used the past season is the Rialto canner, manufactured at Mt. Pleasant, Texas, by the Rialto Canner Company. This outfit is very simple in construction and operation, and can be purchased for $10.00. There are also other makes that are inexpensive and satisfactory. A single outfit has a capacity of 300 2-pound cans and 200 3-pound cans per day when run to its full capacity. Where it is desired to increase the capacity, two or more outfits can be run on a small furnace, built of either brick or rock. The outfit consists of a specially constructed galvanized iron boiler, made to fit either a No. 7 or No. 8 cooking stove; a basket, or carrier, that fits inside the boiler; can tongs and soldering irons. This is a very simple, yet economical and accurate form of the "open process" method of canning.

The operation of the outfit is very simple and quickly learned, and the principle all the way through is the same as that followed in regular canning establishments.

In canning tomatoes the first step is to scald the fruit just sufficient to loosen the skin so that it can be slipped off. To do this we use a large iron kettle, commonly called a wash pot. The tomatoes are placed in a cheap tin vessel, holding about one-third of a bushel, that has been punched full of small holes, and dipped into the boiling water and allowed to remain about one minute, or until the skin will slip readily. The fruit is then peeled, sliced and filled directly into the empty cans. The cans must be well filled for good results. This finishes the first step. The filled cans are then passed to the second stage of the operation. The tops of the cans wiped dry with a clean cloth, the cap placed on and soldered around the rim. The small hole, or vent, in the center of the cap being left open. Then we are ready for the third step, that of exhausting—expelling the air out of the cans. This is accomplished by submerging the cans in the boiling water (in the boiler) about two-thirds of their length. They are held there until they come to a boil, or for tomatoes, ten minutes. They are then removed, the small hole in the center of the top closed with solder, and the cans are then completely submerged in the boiling water and boiled, or processed, twenty minutes, which is the fourth, and last, step in the operation.

Then, summed up, the different steps or stages of the complete operation are as follows:

(1) Scalding, peeling and filling; (2) wiping and soldering the cans; (3) exhausting and tipping; (4) processing or cooking.

The scope of the work of home canning is almost unlimited. The canner can be run almost constantly from May until November. Beginning in May with all kinds of berries (especially strawberries and blackberries), we go right on through the summer with vegetables and fruits and during the fall with sweet potatoes. A list of the leading fruits and vegetables that can be successfully put up are as follows: Fruits—Strawberries, blackberries, peaches, plums, pears, apples, figs. Vegetables—Tomatoes, beans, okra, sweet potatoes. Peas and corn cannot be very successfully canned on an outfit of this kind, as they require a higher pressure than the above, and for this purpose the closed kettle is necessary.

Some data concerning the cost of running this outfit was obtained the past season, and our figures are based on the operation of two canners, giving a maximum capacity of 600 2-pound cans (tomatoes) and 400 3-pound cans (peaches or pears) per day. For the debit side we have as follows:

(1)	Picking and delivering fruit, 2 boys at 60 cents per day	$ 1 20
(2)	Scalding, peeling, filling, 2 boys at 60 cents per day	1 20
(3)	Wiping and soldering, 1 man at $1 50 per day	1 50
(4)	Processing, 1 man at $1 50 per day	1 50
(5)	600 2-pound cans, at 2 1-2 cents each	15 00
	Solder for the cans	1 00
	Total cost per day	$21 40

Undoubtedly, the chief value of an outfit of this kind lies in the opportunity afforded of utilizing the surplus that cannot be profitably shipped to market. With tomatoes and peaches, and often with nearly all kinds of vegetables and fruits, the period wherein profitable shipments can be made comes to an end before the crop is exhausted. Therefore, what remains need not be lost, but is turned into a nice profit by canning.

For tomatoes put up the past season, the Station received a net price of 70 cents per dozen, which would give a credit as follows: Six hundred 2-pound cans, or 50 dozen, at 70 cents per dozen, $35.00; leaving a balance of $13.60 per day. For the best grade of peaches put up, we received a net price of $1.75 per dozen. These were put up in a syrup made of high grade sugar. The sugar is poured into warm water until a density of 10 Beaume is reached and the cans are then filled with the syrup instead of clear water. Approximately 1 1-2 pounds of sugar was used to each dozen cans, and the 3-pound, or peach, cans cost 3 cents each. With two outfits the maximum capacity of the 3-pound cans in putting up peaches is 400 cans per day. These are put up with the same labor as given for tomatoes above, and we have as follows:

(1)	For labor	$ 5 40
(2)	400 3-pound cans, at 3 cents each	12 00
(3)	50 pounds sugar, at 6 cents per pound	3 00
	Total	$20 40

On the credit side we have 400 3-pound cans of fancy peaches, or 33 1-3 dozen, at $1.75 per dozen, giving a total of $58.33 1-3.

We also put up a quantity of peaches plain, or in their own juice; these do not require any sugar, but simply clear water. This grade must be sold as pie peaches, and the prices are about $1.00 per dozen.

Pears are put up the same as the peaches, at about the same cost. The prices for the finer grades are the same as for the peaches.

We found that the pears yielded a larger profit than the peaches, other things being equal, as one bushel of pears filled an average of 24 3-pound cans, and one bushel of peaches only 16 3-pound cans.

Our canning work this season was only preliminary, but perfectly successful, and will serve as a basis for future work that should yield very profitable results.

SECOND SERIES, NO. 82.

BULLETIN

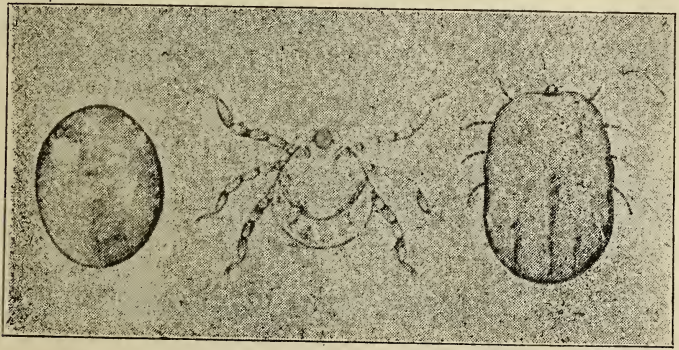
OF THE

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

W. R. DODSON, A. B., B. S., Director.



THE TEXAS FEVER CATTLE TICK SITUATION

AND THE

Eradication of the Tick by a Pasture Rotation System.

By H. A. MORGAN.

Issued by the State Board of Agriculture and Immigration.
J. G. LEE, COMMISSIONER.

BATON ROUGE:
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AND A. & M. COLLEGE.

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The Bulletins and Reports will be sent free of charge to all farmers, by applying to the Director of the Stations, Baton Rouge, La.

LETTER OF TRANSMITTAL.

Louisiana State University,
Office of Director Experiment Stations,
Baton Rouge, La.

Maj. J. G. Lee, Commissioner of Agriculture, Baton Rouge, La.

Dear Sir: I hereby transmit for publication as Station Bulletin No. 82, the results of continued work on the "Cattle Tick" by Prof. H. A. Morgan, who has given this subject special attention for a number of years. Bulletins 51 and 56, Second Series, deal with the results obtained prior to 1898. Since then further investigations have been made for the purpose of learning the period of incubation of tick eggs and development of the ticks during each month of the year, with the hope of discovering the most practical plan of economically eradicating the ticks from the pastures. Professor Morgan has successfully demonstrated that the ticks of the South can be easily controlled and even completely eradicated by a method that can easily be put into practice on any place in the State, if care and system prevail, for a few months. This discovery of a simple and practical plan of getting rid of the ticks without the use of dips or chemicals of any kind, will be of inestimable value to the South if the people will but avail themselves of the opportunity of putting it into operation.

It is not only a question of dealing with the fever which hinders the importation of the highly bred beef animals of other parts of the country to improve our herds, but it is a question of great importance as pertains to our native cattle.

Observation and experiment have demonstrated that no animal can thrive when heavily infested with ticks. The Experiment Station has shown that the best animals can not be fed so as to make profitable returns for the feed consumed, while the animals being fed are heavily infested with this parasite. Therefore, aside from the question of immunizing improved breeds of animals, the tick is the greatest menace to the profitable raising and feeding of our native cattle.

It is to be hoped that the people of the South will realize the possibility of eradicating this disease-carrying tick, and persistently push the work of extermination till there shall be no "Texas fever" quarantine line in the United States. If this end can be accomplished, and it is easily within the range of possibility, the South will become a great stock-producing section. Viewed in this light this bulletin may justly be considered one of the most valuable yet published on this extremely important question.

Professor Morgan has recently severed his connection with the Louisiana stations to become Director of the Tennessee station. It is unfortunate for Louisiana to have to lose the services of a man so familiar with every phase of this great question, but we shall still have his services in a broader field in aiding to make this a question for the whole South to solve.

Very respectfully submitted,

W. R. Dodson, Director.

THE TEXAS FEVER CATTLE TICK SITUATION.

IN GENERAL.

Outside of the immediate Gulf Coast region, which is menaced by the prevalence of charbon (anthrax), horse flies, and mosquitoes, there is no serious obstacle to profitable beef and dairy production in the South other than the North American Texas fever cattle tick *(Boophilus annulatus)*. This fever-conveying parasite of cattle has effectually discouraged and suppressed attempts to develop generally the beef and dairy industries of the tick-infested areas. It has been a millstone about the necks of those who have engaged in the cattle business, and is in a great measure responsible for the reluctance with which many farmers accept the gospel of diversification. This tick inflicts a double tax upon cattle. Aside from being the conveyor of the death-producing and life-sapping germ of Texas fever, its habits and development are such that upon permanent pasture areas ticks become so enormously abundant as to check the growth and maturity, and the development of the beef and dairy possibilities, of the animals they infest. These combined effects make the cattle business hazardous and have forced many farmers to abandon cattle raising in spite of the fact that the Bermuda, carpet grass and Lespedeza pastures of the area involved are not excelled for grazing purposes even by the blue-grass and other famous pasture regions above the quarantine line.

IMMUNITY AND BLOOD INOCULATION.

Great relief was felt a few years ago when some of the experiment stations of this country worked out, to a practical degree at least, a way of successfully immunizing, by blood inoculation, cattle susceptible to Texas fever. This achievement brought fresh courage to the farmers of the tick-infested area, especially to those who have realilzed what it would mean for the agricultural interests of the South to have some form of cattle raising an integral part of every well-organized farm. With inoculation, the pendulum of confidence swung too far the other way; not because of any lack of merit in the plan of immunization, but because persons unfamiliar with the complications of the whole tick situation made investments confident that the fever phase of the question was the main one and that blood inoculation solved it. Recent experiences prove that the fever germ becomes more virulent if perpetuated in ticks bred upon recently immunized or partially susceptible animals, and that the so-called native animals, usually accepted as naturally immunized, when reduced in flesh from intense infestation of ticks of the virulent type, or from other causes, show more or less distinct symptoms of Texas fever. These facts, coupled with the one that an immunized mother transmits little if any immunity to her offspring, multiply the complexity of the problems. Blood inoculation has given very satisfactory insurance against the death of imported non-immune animals, but it does not insure the feeder against the failure of his animals to make profitable gains when he attempts to utilize the infested pastures of his farm with or without supplemental concentrates, utilizing the by-products of some of the South's staple crops.

NATIONAL QUARANTINE.

Through the efficient efforts of the Bureau of Animal Industry of the United States Department of Agriculture, working in co-operation with the States bordering the northern tick boundary, the spread of the tick has been limited and the area infested considerably reduced. A vigorous quarantine has been. inaugurated and maintained, and during the major part of the year no animals are allowed to pass from below the quarantine line except for the purpose of immediate slaughter. The necessity for quarantine restrictions no one questions. The annual saving to the country by the protection it maintains is difficult to estimate, but the embargo peculiarly emphasizes the magnitude of the tick problems and the demand for a practical remedy. The Southern breeder naturally asks the question if the time will not come when animals other than those for immediate slaughter will be in demand north of the quarantine line, and if the prize ring of the national beef and dairy shows is always to remain closed to the products of his breeding and feeding skill. If this be so, the problem warrants an earnest effort on the part of every farmer living in the infested area to eradicate the fever tick from this country. Extermination is not impossible, but it can not be accomplished without careful study and intelligent co-operation.

SUMMARY—I.

Experiments conducted in this and other States warrant the following conclusions upon the fever side of the cattle tick situation:

1. The cattle tick *(Boophilus annulatus)* is the only species in the United States capable of conveying the Texas fever germ from one animal to another (cattle).

2. The degree of virulence of the fever germ transmitted by individual ticks depends to a very great extent upon the susceptibility of the animals upon which the immediate progenitors of these ticks were developed. Hence, an animal recently immunized (by blood inoculation) will suffer less from tick fever if pastured with a number of native cattle than if permitted to collect seed ticks, the immediate offspring of those developed upon this inoculated animal. The offspring of cattle ticks developed a few generations on horses and mules, in the blood of which the germ becomes innocuous, are non-transmitters of fever. These conditions, together with incorrect identifications, account for the belief of some stock owners that ticks do not transmit Texas fever.

3. It is possible to give a marked degree of immunity by hypodermic injections of fresh defibrinated blood (1 to 5 c. c.) from a non-susceptible tick-infested animal or by gradual and limited artificial application of young ticks (seed ticks), the product of old ticks developed on animals which have had Texas fever either from inoculation or from tick infestation.

4. Young animals suffer less during immunization than older ones, unless changes in dentition disqualify them for the range, in which case judicious feeding must be resorted to. In fact, during the fever period (sixty days) animals should be placed upon a nutritious, well balanced ration.

5. With higher priced animals it is better to inoculate the calves at from six to nine months old than to permit promiscuous tick infestation, and consequent serious check in development when a week or more old, as is the case with calves dropped upon infested pastures.

THE ERADIGATION OF THE TIGK BY A PASTURE ROTATION SYSTEM.

There are five species of ticks found upon cattle in Louisiana which the stock raiser might experience some difficulty in differentiating: the North American Texas fever tick *(Boophilus annulatus)*, the lone star tick *(Amblyomma americanum), the* dog tick *(Dermacentor electus)*, the net tick *(Dermacentor reticulatus)*, and the castor bean tick *(Ixodes ricinus)*. The first is the only one which should give the breeder any concern, but persons not familiar with the specific differences have confused the habits and development of the fever tick with those of the lone star, dog and net ticks. While the habits (except in selection of hosts) and development of all these species are very similar up to attachment to host animals in the seed tick condition of each, there is a very marked difference in habits and development of the fever tick and the three other species from the period just before the first molt to the fully mature and engorged females. The fever tick remains upon its host throughout the molting periods up to engorgement, while the other species drop from their hosts just prior to each molt. The latter habit greatly prolongs the life cycles of the lone star, dog and net ticks, even to as much as ten months or a year, and in consequence reduces the numbers to such an extent that they are not in any sense serious pests.

LIFE CYCLE OF FEVER TICK.

As the pasture rotation remedy for the Texas fever tick is based upon a study of the life history and habit, a general statement of the development of this species is given in order that the plan proposed for its extermination may be more clearly understood.

The fully engorged females (that stage most commonly observed upon animals) detaches itself from its host, drops to the ground, and deposits as many as 3,000 eggs. The number of eggs laid by individual ticks and the time required to deposit them vary with the food and temperature conditions. In summer, with food conditions normal, even more than 3,000 eggs may be deposited in a few days; in late fall and winter as long as a month or more may be consumed in laying half, and less than half, of the eggs a tick of the same size would deposit in summer. Eggs laid in summer hatch in from twenty to thirty days, while those deposited in late fall and winter months may not hatch until the following March or April. On hatching, the ticks are called "seed ticks" in distinguishing them from the "yearling" ticks (stage after first and second molts) of the lone star and dog tick species, which may collect upon a person in walking through a pasture or woodland, or from the same stages of the fever tick found upon cattle. The seed ticks bunch in an exceedingly local manner upon grass and twigs of weeds and shrubs, and there await the passing of some animal to which they attach. These seed ticks possess remarkable vitality in that they may remain in a pasture as long as two months in summer and over six in winter before perishing in case no host animal should pass and collect them. On being collected by a host animal the young ticks soon attach themselves and begin their parasitic life. The time required to develop (molts twice) upon cattle is important in connection with the remedy suggested. During the midsummer, full engorgement of the mature tick ranges from nineteen to thirty days after attachment, while in late fall and winter the cycle of development upon cattle is usually a few days longer, ranging from twenty-eight to forty days.

From the foregoing it will be seen that the female ticks during the egg laying period, the eggs, and the young ticks (seed ticks) prior to attaching to animals, are to be found on the ground of pasture fields and not on animals; while the remaining stages—seed ticks after attachment, stage after first molt and stage after second molt to engorgement of females—are consecutively developed upon the animals, and at no time upon the ground, grass, weeds or shrubs of the pasture.

DATA AND PASTURE ROTATION. REMEDY I.—(a).

In the study of the development of the Texas fever cattle tick during the summer months it was found that the time required for seed ticks after infesting animals to mature into engorged females and drop to the ground for egg deposition was a little less than the time required for a female after dropping to lay eggs, and these eggs to hatch. Therefore infested animals might be cleaned of ticks by being placed in a tick-free field, upon which to drop all their ticks before eggs from females dropped the day the animals were placed in the pasture would hatch. The time between the dropping of the ticks and possible reinfestation was of too short duration for this plan to be practicable in the face of slight developmental variations due to changes in temperature or other conditions. Experiments were conducted in order to determine if a wider range of time between these important suggestive remedial periods did not exist and thus develop a remedy easily within the range of the average farm operations of the State. Continuing the breeding experiments through every month in the year, it was found that eggs deposited the latter part of November and in December, January, and February, did not hatch until late March, April, or early May, and that the longest period of development of the tick (from seed tick to full engorgement and period of dropping) upon cattle during these months was forty days, thirty-five being in most cases ample for the development and dropping of every tick. *It thus became easily possible to place infested animals upon tick-free areas during late November, December, and January, have them drop every tick, and run no risk of reinfestation, as eggs did not hatch under the prevailing temperature of these months.*

DATA AND PASTURE ROTATION. REMEDY I.—(b).

The next phase in the development of a practical remedy was the determining of the length of time necessary to starve ticks out of a pasture when all hosts (cattle, horses and mules) were excluded. Experiments during the summers from 1897 to 1904, inclusive, showed that about one month was necessary for the laying and hatching of eggs and that seed ticks could endure as long as two months in summer without food. For example, if all hosts of the cattle tick were removed from a pasture on June 1 this pasture would be tick free by early October.

The fall and winter months, though a decidedly opportune period for ridding animals of ticks, were found least effective as a period for cleaning pastures by excluding cattle tick hosts. Eggs deposited in late fall may not hatch until the next March or April, and seed ticks may live without food from late September until the middle of the following April. It will thus be seen that more time is required during the late fall and winter months to deposit and hatch tick eggs or to starve out seed ticks than is necessary during midsummer to effect both operations.

With this information a remedial application may be perfected to meet the conditions upon the farms or plantations of the South. Pastures may be divided so that from a portion of them all animals (cattle, horses and mules) upon which the Texas fever cattle tick develops may be excluded from June 1 until late fall in order that the animals when cleaned of ticks may have a tick-free field in which to be placed. To be cleaned the animals may be placed, not earlier than the middle of November, in a corn or cotton field from which the crop has been removed, and there kept until the ticks have dropped (thirty-five or forty days). In no case should they have access to the pasture from which they have just been taken, as animals may become infested during a warm spell of the winter months with seed ticks which hatched in September or early October. (Seed ticks hatched September 29, 1903, remained alive without food until April 10, 1904). As soon as all ticks are dropped the animals may be removed to the tick-free field, or they may remain longer without danger of reinfestation if the corn or cotton field provides sufficient pasturage. Not later than February they should be placed in the tick-free field to be fed the hay crop gotten from this area the previous season. Upon this tick-free area they may be kept until sufficient time has elapsed to destroy the ticks by starvation in the pasture from which they were removed into the corn or cotton field the fall previous.

"FEED-LOT" METHOD OF RIDDING CATTLE AND OF CLEANING PASTURES DURING SUMMER. REMEDY II.

It should be remembered that not all farms nor all fields of individual farms lying below the national quarantine line are infested with the fever tick. Parishes of Louisiana devoted to sugar cane and rice culture are practically free from ticks. Many cotton plantations are also exempt, and those parts of all farms upon which no cattle have been from June 1 until October 1, or later, are also tick-free. These areas may be advantageously used in eradicating the fever tick from contiguous ones.

The ''feed-lot'' method of cleaning cattle is based upon the fact that the parasitic period (from attachment as seed tick to dropping to ground as a fully engorged female) of the fever tick is not more than forty days; less in summer. In this method a portion of ground is set apart, half of which is of sufficient size to accommodate the number of cattle on hand. The area selected should be convenient to plenty of feed and water. Surround and divide the lot with a double fence (eight to ten feet space). Feed the cattle for twenty days on one side, then remove them to the other for fifteen or twenty days longer. Every tick will have dropped, and the cattle may then be placed upon such field or pasture as may be tick-free and available. By this method entire farms may be cleaned during a summer period of not exceeding four months. In the early spring select a field with water and shade available to be devoted to broadcast sorghum, corn or millet, or all three. On June 1 fence off the feed-lot (within the forage field), in which place all the cattle of the farm, and feed and rotate as described above for forty days. At the end of this period the cattle may be turned into the field of sorghum, millet or corn and there pastured until October 15 or November 1, by which time all fever ticks upon the entire property outside of the feed-lots will have perished.

After the animals are removed the feed-lots should be immediately plowed and thoroughly cultivated, and their edges completely sprayed with crude petroleum, zenoleum solutions, or other substances destructive to tick life.

SUMMARY—II.

1. The North American cattle tick has been bred upon cattle, horses and mules. Horses and mules are not continuously infested when upon ticky pastures as are cattle.

2. Sheep and goats run upon pastures scatter bunches of seed ticks and reduce possible infestation of cattle upon the same pastures.

3. The excessive tax of gross infestation of ticks is not only shown by the great loss of flesh of animals attacked, but in the slower development of ticks on animals intensely infested.

4. In connection with the two pasture methods suggested for the eradication of the fever tick, the periods of greatest importance in the life of this tick are, (1) the combined egg laying and incubation, which takes place *upon the ground of the pasture*, and (2) the development of the tick *upon cattle* (from the time the seed ticks are collected from the pasture and attach, through the two molting periods, to the engorgement and dropping of the females). Eggs hatch readily in from twenty to thirty days from May until early October. Those deposited in the latter half of November, in December, January, February, and early March, hatch in April and May; earlier in exceptionally open winters. Ticks develop upon cattle in from about nineteen to thirty days in summer, and the longest winter development upon cattle was found to be forty days.

5. More eggs as a rule are deposited in summer than in winter. Many females succumb to the cold before depositing half as many eggs as females of the same size would deposit in summer.

6. Seed ticks possess remarkable vitality, having been found to be able to exist without food as long as two months in summer and over six in late fall, winter, and early spring.

7. From a study of the life and habits of the fever tick, two plans have been developed for its eradication: (1) a pasture rotation system, utilizing June, July, August, September, and October to starve out the tick from pastures by excluding cattle, horses, and mules; (2) the adoption of the feed-lot method within a sorghum, corn, millet or other forage field conveniently located for water and shade.

8. Animals south of the quarantine line may any time

during the year be absolutely cleaned of ticks in forty days or less by the feed-lot method.

9. Seed ticks hatched in late September and October, living as they can, as long as six months, may infest cattle during any warm spell from late September until April.

10. While a number of substances are of great value in reducing tick infestation of animals, they are attended with some loss, considerable expense, and much worry, and can not be relied upon for complete eradication except when associated with the pasture rotation remedy. Many substances used to lessen tick infestation irritate the skins of animals and lengthen the period of development of ticks which survive the effect of the application.

During the summer of 1904 the writer had the opportunity of testing on a large scale the plans of eradicating ticks as set forth in this bulletin upon the property of Mr. August Mayer, Shreveport, La. In corresponding with Mr. Mayer relative to the results, we have received the following letter, which Mr. Mayer has kindly permitted us to publish:

LETTER FROM MR. AUGUST MAYER.

"SHREVEPORT, LA., April 20, 1905.

"*Prof. H. A. Morgan*—

"MY DEAR SIR: With the advent of the boll weevil the problem of the total eradication of the fever-transmitting cattle tick from the pastures of the South, especially from those of the farm, has become of the greatest importance. Next to the problem of maintaining American supremacy in the production of cotton in spite of the boll weevil, there is no problem facing the Southern people today of greater consequence than the one dealing with the eradication of the cattle tick *(Boophilus annulatus)* from the United States. Indeed, it may be said that the damage done annually by the cattle tick at present exceeds that wrought by the boll weevil, and this enormous loss, amounting perhaps to more than one hundred million dollars, has been suffered for many years.

"To explain by a concrete example how formidable a barrier the fever tick is to a profitable cattle industry on the farms of the South, I may cite my own struggles in the building up of a herd of full-blooded cattle. After expending over ten thousand dollars in the importation of registered non-immune stock, and battling with the fever tick for several years, to have the cattle survive and become reproductive, experiencing losses by deaths in the herd from tick fever representing in the aggregate over two thousand dollars, and further outlays of several thousand dollars for extra feed, care, etc., all chargeable to the cattle tick, I saw almost no hope for success in my enterprise. Grave thoughts of surrender to the tick crowded my mind. And had it not been for the knowledge gained from your exepriments, in the nick of time, and your kind assistance in my last stand against the tick, my attempt to raise fine cattle profitably on the richest soil in the world would have proved a failure. How well we succeeded by your 'feed-lot' method in freeing my herd of cattle completely from the ticks and restoring new life and vigor to them, I am only too happy to testify. Your experiments have proved to my entire satisfaction that the cattle tick need have no terrors for him who informs himself thoroughly of its habits and life history and follows out your plans for its control and eradication.

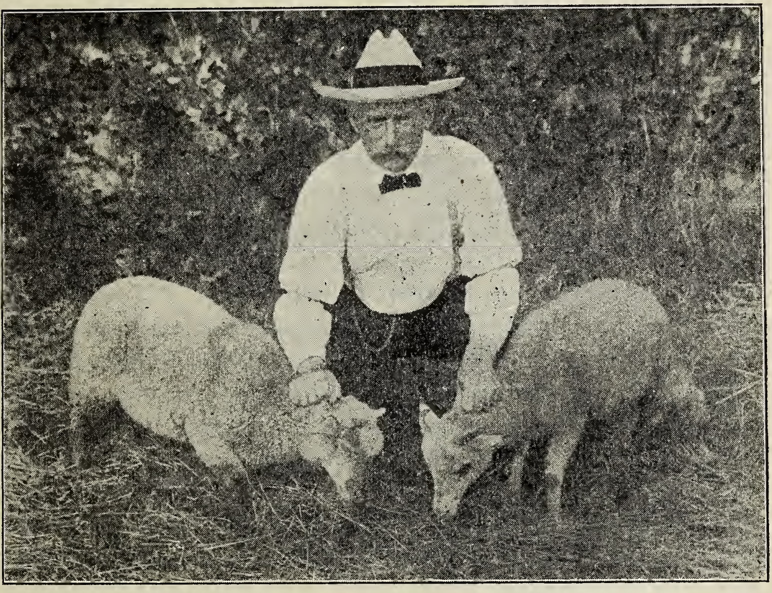
"At the same time, I wish to sound a note of warning to my fellow-farmers below the quarantine line, especially to those owning rich pasture lands capable of carrying a comparatively large number of animals per acre, to take it at once for granted that the fever tick and a profitable cattle industry are antagonistic propositions. However, until the tick has been completely eradicated from the United States—a thing quite possible—it is only the course of wisdom to see to the thorough immunization of all cattle destined to live below the fever line, even if some of our pastures, or all of those belonging to the more progressive individuals in communities here and there, are tick-free. But after thorough immunization the cattle should be kept free from ticks in order to obtain good results. Pursuing such a course, one will succeed in adding to his calling a branch of agriculture at once profitable, enjoyable, and ennobling to the highest degree.

"Sincerely yours,

"AUGUST MAYER."

SECOND SERIES, NO. 83.

BULLETIN
OF THE
Agricultural Experiment Station
OF THE
Louisiana State University and A. & M. College.



GRADE vs. "SCRUB."

Age, 129 days; weight, 43 lbs. Age, 155 days; weight, 32 lbs.

Results of Further Experiment with Nodule-Disease of the Intestines of Sheep.

"Bare-Lot" Method of Raising Lambs.

By W. H. Dalrymple, M. R. C. V. S.

BATON ROUGE:
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The Bulletins and Reports will be sent free of charge to all farmers, by applying to the Director of the Stations, Baton Rouge, La.

RESULTS OF FURTHER EXPERIMENT WITH NODULE-DISEASE OF THE INTESTINES OF SHEEP.

"BARE LOT" METHOD OF RAISING LAMBS.

By W. H. DALRYMPLE.

For several seasons past, the Veterinary Department of this Station has been conducting experiments in connection with "nodule-disease of the intestines of sheep"—a parasitic ailment which seems to be quite general over the entire country—with the view of ascertaining, if possible, some practical method by which infection (a parasite: the *Oesophagostoma columbianum*) might be eliminated from pastures.

Experiments previously undertaken, and recorded in Bulletin No. 79 (Second Series), went to show that when sheep suffering from this disease were placed upon a, hitherto, clean pasture and allowed to remain on it for some time, the latter became contaminated, as was afterwards proved by the fact that clean lambs, when permitted to occupy this pasture. contracted the disease; while other lambs, born and raised under similar conditions, up to weaning, but not placed on the pasture, did not become affected; which was, in each instance, verified by *post mortem* examination. Also, that when the infected pasture was plowed up, and cropped for one season, infection was destroyed, as was later proved by placing on it other clean lambs, and which, on autopsy, showed no sign of nodules whatever.

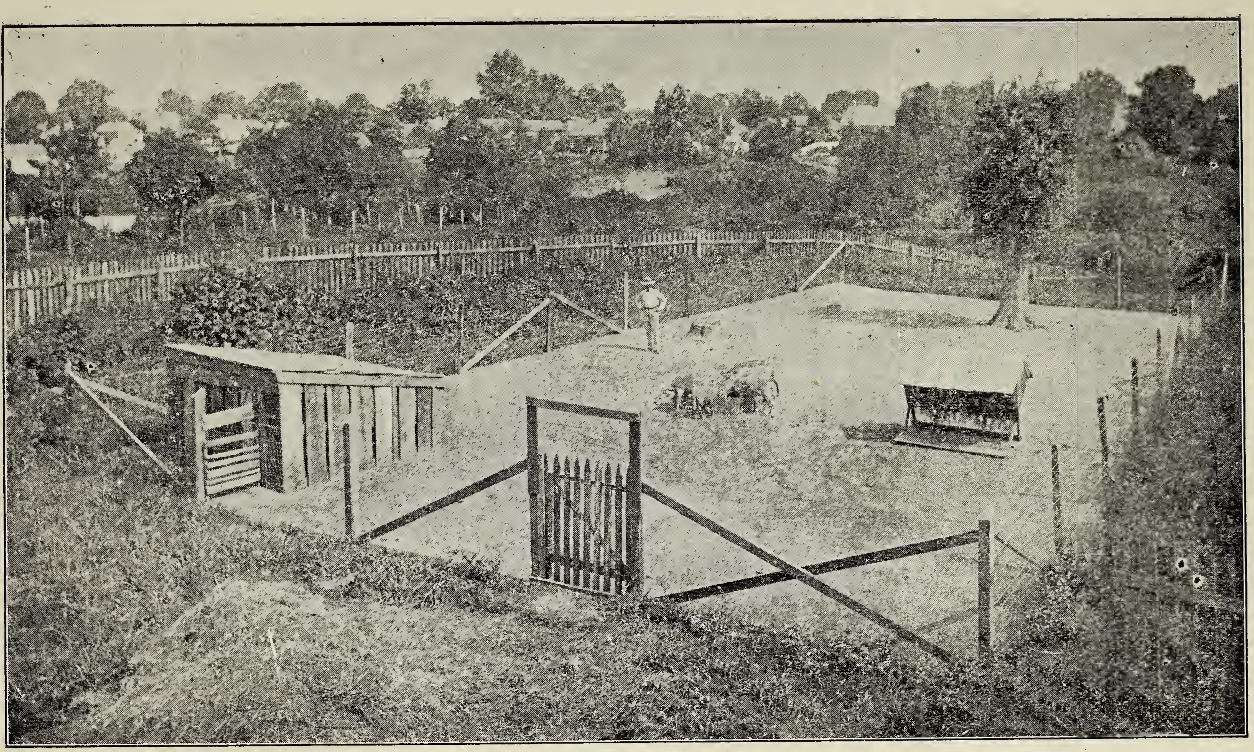
We allude to these previous results, all of which have been fully recorded in the Bulletin above mentioned, as prefatory to those of the experiment to be given in these pages.

It was found that when endeavoring to raise clean lambs for the previous tests, we were doing so, notwithstanding the fact of their mothers being severely affected with nodule-disease. And while our object at the time was to obtain sound lambs to test the matter of pasture infection, it occurred to us that if some easy and practical method could be adopted by which lambs could be raised, until weaned, along with their nodule-diseased mothers, and remain free, or practically so, from the parasite, it would be a considerable boon to those flockmasters whose breeding ewes were infested, and likely to afterwards transmit the disease to their progeny, through the medium of the pasture, under ordinary conditions.

Having shown by previous experiments that the parasite, in some form, evidently passes from the diseased ewe to the pasture, and is, subsequently, picked up by the lamb while grazing, we thought it feasible to presume that if no grazing should be provided, the lambs would escape infestation by the nodule-disease worm. Consequently, a "bare-lot" method suggested itself, and was adopted, and provision made for soiling (feeding cut green food in the lot) the sheep and lambs until the latter should be separated from their dams, when they could either be fed and fattened for the market in this way or placed upon a clean pasture.

The lot in which the experiment was conducted (see illustration) was prepared by hoeing, and the grass raked and removed, so as to obtain a bare earth surface and leave nothing on it that would induce the lambs to pick from the ground. The space occupied was eighty-four feet long by thirty-nine feet wide, and it was fenced round by wire netting, so as to protect the ewes and lambs from the possibility of being preyed upon by enemies, such as wandering dogs. The lot, in short, was made to represent, as nearly as possible, a bare space around the farmstead, which, probably, already existed, or which could, without much trouble, be made to meet the requirements, by plowing and harrowing, and enclosing by a fence. The size of such lot, or lots, to be according to the room required by the ewes and lambs.

The surface of the enclosure was kept reasonably free from grass. That is to say, a spear or two of grass might occasionally be seen here and there; but our object was to have the lot as clean as we might expect it to be kept by the flockmaster, even by what he might consider to be, the expenditure of a little extra effort; realizing, all through the test, that, should the results prove satisfactory, the method, even then, was only likely to be adopted if it came within the range of easy practicability. Anticipating



VIEW OF BARE-LOT.

this, then, and in order to give encouragement to those interested to give the bare-lot method a trial, in the event of its success, we endeavored to adapt our work, as nearly as we thought possible, to that which the sheepowner was likely to pursue.

The surface of the ground was made even, so as to avoid any rainwater standing in pools to become contaminated, and which might tend to produce infestation, through the lambs drinking from them. There was a slight declivity in one direction, which favored and hastened surface drainage.

A small shed of sufficient size was erected in one corner of the lot for shelter, in which was kept a light bed of sawdust.

The ewes were fed a medium quantity of concentrated food, such as oats and bran, crushed grains, etc., once a day, out of a wooden trough, mainly to stimulate milk-secretion, as we were anxious that the lambs should do well, especially at the start; and afterwards, when the lambs were able to eat, they, too, partook of the concentrated food along with their mothers.

A rack was provided, and soiling was practised all through the experiment; the green food being of different kinds, obtainable on the Station during the time. The general practice was to supply green food twice a day, and, in the interval, to have the rack replete with good grass hay.

Fresh water was always kept in quantity in a wooden trough, and the sheep had no other place at which to quench their thirst.

Around the rack, all the hay and green food which had been pulled out onto the ground, was raked up at night and removed from the lot.

In fact, all of the labor attaching to the experiment may be comprised in the following epitome:

Preparing and fencing a bare-lot; keeping the lot free of grass; feeding concentrates, or any short food, out of a trough; keeping the ground free from low places where rainwater might accumulate and remain; providing a constant supply of fresh water in a trough, or other suitable receptacle; feeding green food and hay out of a rack, and cleaning up and removing the refuse roughage from the ground around the rack, or other feeding convenience, once a day.

As a practical measure, the bare-lot method is adaptable, of course, more, if not entirely, to farm, rather than to range conditions; and we believe that there is no part of the work but what any sheepraiser would willingly undertake, provided he was interested in the production of lambs that were free, or practically free, from nodule-disease.

Six ewes, of common and mixed breeding, were purchased from a flock that was infested with the nodule-disease worm.

On February 4th, 1905, the sheep were placed in the bare-lot. February 5th, lamb No. 1 was born.

February 7th, another lamb came, but died the following day, probably through being injured. No number is given this lamb.

On March 3d, lamb No. 2 was born.

As we were anxious to secure at least six lambs for the experiment, and the remaining ewes seemed slow in giving birth, other three were purchased (somewhat younger animals), and were, on March 29th, placed in the lot with the rest.

March 30th, lamb No. 3 was born; March 31st, No. 4; April 3d, No. 5; and on April 8th, No. 6.

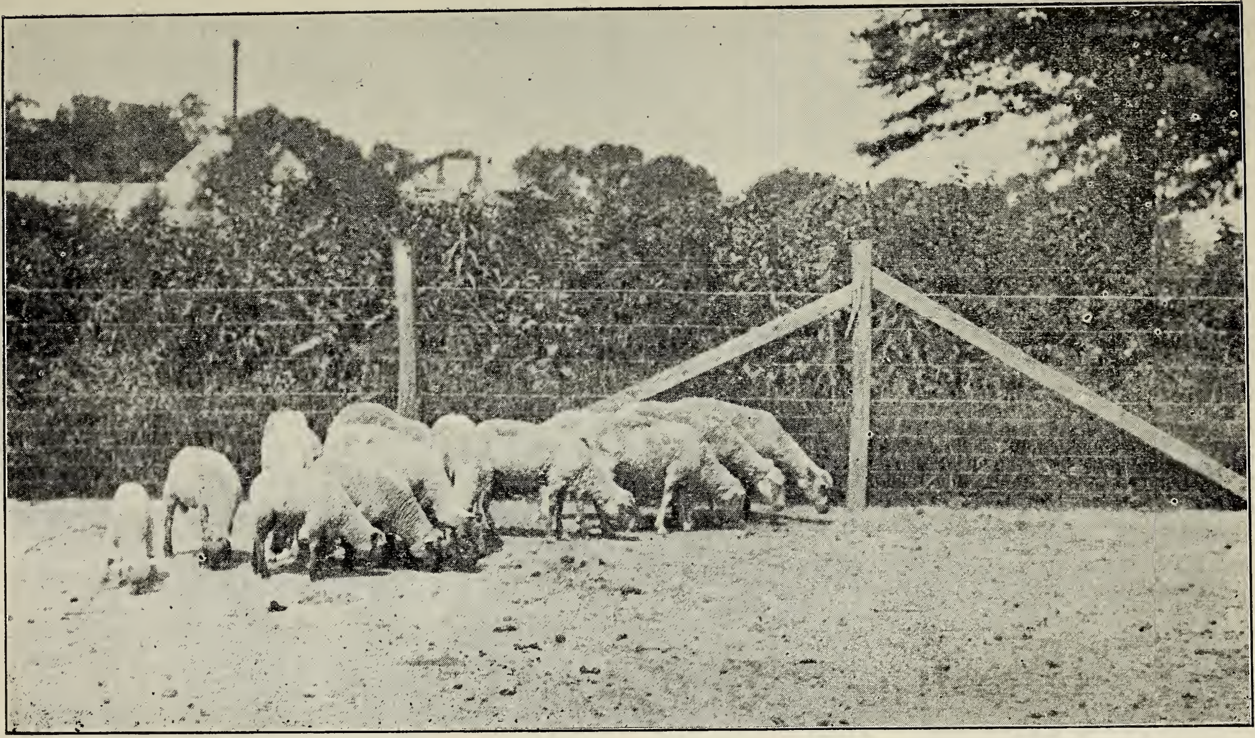
From the nine ewes we were able to obtain six lambs. Two of the ewes proved to be non-pregnant, and another lost its lamb, but all of them were allowed to remain in the lot to add to the infection.

The ewes being rather heavily fleeced and "burry," and in order to prevent any cockleburrs interfering with nursing, the sheep were shorn between April 10th and 29th.

On June 29th, all the lambs having, apparently, been weaned by their mothers, the latter were disposed of, and on being slaughtered, their intestines were found covered with nodules.

June 30th, lamb No. 5, which was observed to be ailing the previous day, was destroyed and examined, and found free from nodules. However, a considerable number of stomach worms (*Strongylus contortus*) were present in the fourth compartment of the stomach, which, in our opinion, largely accounted for its condition. The lamb was eighty-eight days old.

The presence of stomach worms was somewhat of a disappointment, as we were hopeful that the bare-lot method, in the



EWES AND LAMBS IN BARE-LOT.

condition in which we kept the enclosure, might prove successful in preventing infestation by these, and other intestinal parasites, as well as the nodule-disease worm.

As the lot, previous to placing these ewes on it, never had been occupied by sheep, it seems feasible to presume that the stomach worms must have been imported along with the ewes. And there seems no question that the presence of the stomach worms had a prejudicial effect on the condition of some of the lambs. In other words, if the lambs had had to contend only with the nodule-disease parasite, they would have shown a more uniformly healthy condition.

On July 11th, lambs Nos. 1 and 2 were examined. No. 1 (a scrub male lamb), age 155 days, and weighing, alive, 32 pounds, showed no sign of nodules on the intestines, but some stomach worms were present in the abomasum (fourth stomach).

No. 2, a grade ewe lamb in good condition, 129 days old and weighing 43 pounds, showed two small "pinhead" nodules on the caecum (a portion of the large bowel) and some stomach worms in the fourth stomach.

On the same day, No. 6, the youngest lamb of the bunch, viz: ninety-three days old, was examined. Its intestines showed no sign of nodules, but harbored a tape worm (*Taenia expansa*) and numerous stomach worms were found in the fourth compartment of the stomach.

July 17th, No. 3, a male, was examined. This lamb weighed 42 pounds at 108 days old. Three "pinhead" nodules were found on the caecum; a tape worm in the small intestine; and numerous stomach worms in the abomasum.

No. 4, examined the same day, exhibited two "pinhead" nodules on the caecum, and stomach worms in the abomasum. This lamb weighed only 26 pounds live weight, at 107 days old. The term, "pinhead," is not a specific one, but used simply to convey an idea of the size of the nodules.

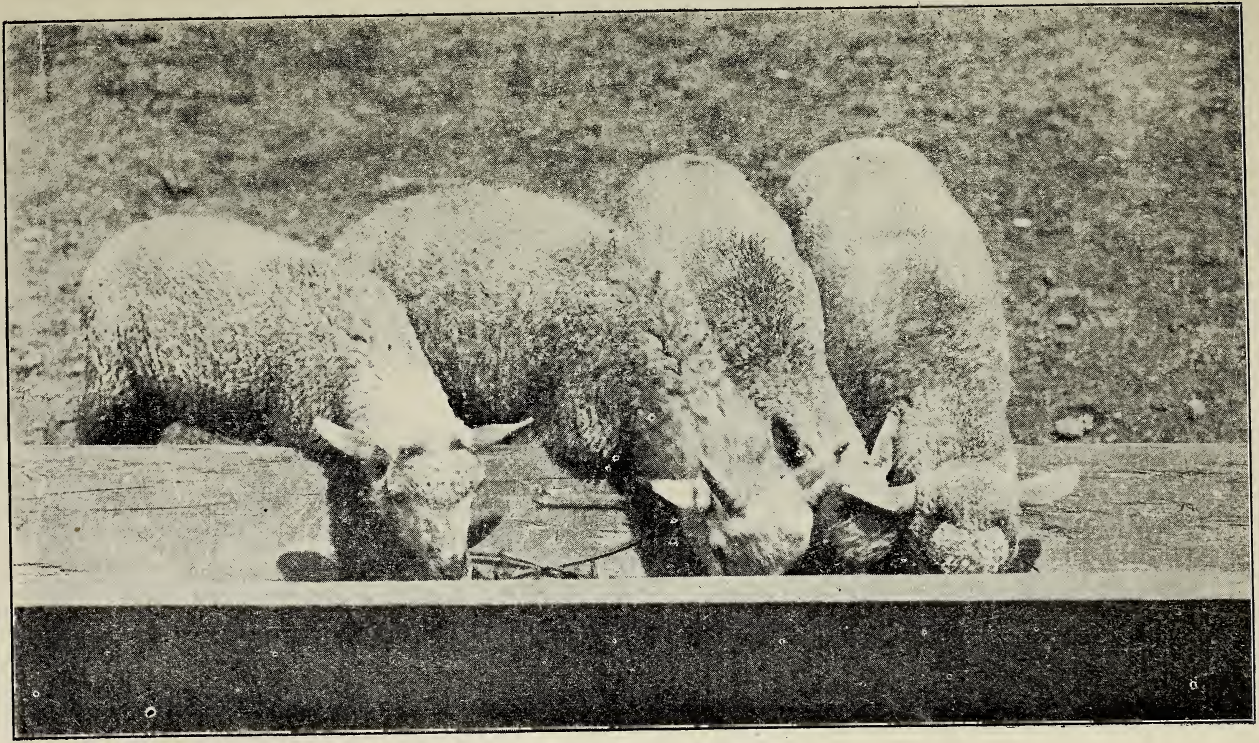
It may be stated that all of the lambs, with the exception of No. 1 and No. 3, were grades, mostly from common ewes, probably by a Southdown ram. No. 1 was a "scrub," while No. 3 was a pure Southdown. And, had it not been for the "handicap" imposed upon the lambs, by the presence of stomach worms, and tapes, neither of which we had reckoned for in our experiment, the condition of the animals would, doubtless, have made a much better showing. Still, after all, the intruding parasites did not vitiate the work, which was mainly to test the possibility of raising lambs, until weaned, and in company with their diseased mothers, free, or practically so, from nodule-disease of the intestines; and, at the same time, with the minimum of trouble to the flockmaster, which we feel was accomplished in a fairly successful manner. The butcher who got the four larger lambs stated to the writer that Nos. 2 and 3 were the finest he had handled in many a day, and that the meat was the best he had ever tasted.

Being desirous of viewing the proposition from all practical standpoints, we put to ourselves the question: Would the bare-lot method, as likely to be carried out in practice by the sheep-owner, prove to be absolutely successful under all conditions? So far as the nodule-disease is concerned, we believe it would be practically so, in the case of lambs that were to be pushed and fattened for the early, or other markets.

But, helminthologists tells us, that the eggs of the nodule-worm are layed in the intestine of the sheep, and that the embryo worm, after being hatched, begins its work of penetrating into the bowel wall and producing the nodular condition. Or, in other words, reproduction seems to take place in the intestine of the same host, after an animal once becomes infested with the parasite, although, doubtless, those that have been picked up from off the ground by the previously clean animals, must have escaped with the bowel discharges of a former host.

As it would seem probable, then, from the experience of those who have made a careful study of the life-history and habits of this worm (*Oesophagostoma columbianum*), that auto-infestation does occur; and, if so, there would be the possibility of ewe lambs, kept for breeding purposes and placed on pasture, still further infesting themselves and contaminating the pasture, provided, of course, they were affected to the extent of even one or two nodules to begin with.

We refer to this as a possibility, although, from our own experience with six weanling lambs, only three of which showed



FOUR OF THE LAMBS AFTER WEANING.

any nodules, and the greatest number found, being only three about the size of a pin's head, there can hardly be any question as to the great reduction in the source and amount of infection, as compared to what it is when lambs are raised along with their mothers on badly-infected grazing.

It should be mentioned, also, that, in our experiment, we depended entirely upon the bare-lot method to prevent infestation, and no medicinal agents, or drugs, of any kind, not even common salt, were used as vermifuges. Had we allowed the lambs free access to some good worm mixture, our results would, doubtless, have been much more satisfactory.

But in that case, it would have been difficult to know whether to attribute the good results to the method or to the mixture. Consequently, the method, alone, was depended upon. At the same time, we would recommend, in practice, that, in conjunction with the bare-lot method, a suitable vermifuge mixture, or even common salt, should always be supplied.

A useful study in comparisons may be seen by referring to the frontispiece, which is a good object lesson for the sheep raiser. This shows lambs Nos. 1 and 2; the one a "scrub," the other, a fairly good grade lamb; both having been raised under identically similar conditions.

No. 1 (the scrub) weighed, alive, only 32 pounds at 155 days old; while the grade lamb weighed 43 pounds at the age of only 129 days. This is surely evidence enough of the fact, that it pays to raise sheep of improved breeding.

From the results of our experiment, we believe we are justified in making the following deductions:

(1) That, by the bare-lot method, it is possible to raise lambs, up to the period of weaning, and without separating them from their affected mothers, practically free from nodule-disease of the intestines.

(2) That, in the absence of intestinal parasites. other than the nodule-disease worm, lambs, intended for feeding for the early, or other, markets, may be raised in this way, without their health being impaired, or their general condition affected by the disease.

(3) That, in the case of ewe lambs to be kept for breeding

purposes, and which may have become only slightly infested, there is the possibility, owing to the life-history of the parasite, as given by helminthologists (those who make a special study of worms), of auto-infestation and subsequent infection of clean pastures on which the lambs may have been placed.

(4) That, although, the previous deduction as to such possibility, may be correct, there can hardly be any question as to the great reduction in the primary infestation by the bare-lot method, as compared to that brought about where the lambs are permitted to graze on pasture infected through the droppings of their diseased mothers.

(5) That, the method is so simple, and is so free from technicalities, that any flockmaster, who will take the trouble to observe ordinary care as to the few details, can obtain, at least, fair results from its adoption.

(6) That, with the supply of some good vermifuge mixture, to which the sheep can have free access at all times, in conjunction with the method, more satisfactory results might be looked for, than was even obtained in our experiment.

(7) That, when the lot becomes infected with other intestinal parasites, such as stomach and tape worms, etc., the method, alone, will not prevent infestation of the lambs by such parasites.

(8) That, the method is worthy of trial by flockmasters owning breeding ewes affected with nodule-disease of the intestines.

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La. Bulletin No. 84. October, 1905

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

BATON ROUGE.

"Longing for the Sunny South."

TEXAS FEVER,

Being a General Summary of our Knowledge of the Subject to Date.

W. H. DALRYMPLE, M. R. C. V. S.

BATON ROUGE:
THE TIMES, OFFICIAL JOURNAL OF LOUISIANA.
1905.

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TEXAS FEVER.

By W. H. Dalrymple.

Owing to the previous literature of the Station, on Texas Fever, having become exhausted, it is the purpose of this bulletin to endeavor to supply, in succinct and practical form, the demand for information on the subject which is constantly being made.

Names Given the Disease.

The term, Texas fever, although in common use in our Southern States, may be considered a misnomer, as the disease is by no means confined to the State of Texas, but is prevalent in those sections of this country where the common cattle tick (*Boophilus annulatus*) exists, and in other countries, as well, although not, perhaps, transmitted by the same species of tick; the former, so far as we are aware, being peculiar to the United States of North America, or, at all events, the American continent.

Other names given to the disease in this country, are: Tick fever, bovine tick fever, Southern cattle fever, besides those of a more local or provincial character, as murrain, red water, black water, yellow water, acclimating fever, acclimatization fever, etc. It would be well, however, that these latter names should be dropped and become obsolete, because they are not uniformly applied, and are, therefore, misleading.

In parts of Great Britain and in many of her dependencies or colonies where the malady exists, the term, "red water," is in general use, except, perhaps, in New South Wales, where the name bovine tick fever has been suggested. In Italy it is known as bovine malaria, and so on.

It might be here stated, that although these names convey to the ordinary mind what the disease is, they are not what might be called specific terms. That is, they do not give a correct idea of its true cause, and, hence, it has lately been the tendency with biologists and scientific investigators to use the term, "*Bovine* *piroplasmosis,*" because the name of the organism (*protozoan*) producing it, is the "*Piroplasma bigeminum,*" discovered by our National Bureau of Animal Industry.

It may be some time before the stockman becomes familiar with "new" names, such as the last one mentioned, but it would very much simplify matters were the disease known, everywhere, by only one name, and that one based upon a definite reason, such as its specific or definite cause.

THE CAUSE.

The one and only cause of Texas fever is a minute or micro-parasite belonging to the animal kingdom (bacteria proper belonging to the vegetable kingdom), and the name given to it by biologists, as before stated, is the *piroplasma bigeminum.*

It is a "two-host" organism. That is, it lives during its life cycle in the bodies of two individual hosts, and does not seem to be able, naturally, to perpetuate itself in the absence of one or the other of them. These are, the bovine animal (ox, cow, etc.) and the common cattle tick, in this country. When transmitted into the circulation of a susceptible animal, it multiplies in the blood, causing destruction of the red cells: reduction in their number, and produces the different symptoms peculiar to the disease, including high fever. When an animal recovers, however, its power of resistance becomes so strengthened against the effect of the parasite as, thereafter, so long as it is exposed to ticks, to remain healthy (immune) although harboring the parasite in its blood.

The common cattle tick, after feeding upon the blood of such immune animal can, through the medium of the progeny of the female tick, transmit the micro-parasite into the circulation of a susceptible animal. And, in this way the germ is perpetuated and the disease spread.

But, if the two hosts—the bovine animal and the tick—are separated as for example by destroying the tick, the infection cannot be disseminated, because the parasite cannot exist outside of the bodies of these host animals. In short, it requires the tick to extract the parasite, along with the blood, from an immune animal which has been previously exposed to ticks, or one suffering from the disease, and inoculate it into the blood of one that is susceptible, before the disease can be transmitted, except through artificial means, which are resorted to in the process of artificial immunization.

THE COMMON CATTLE TICK THE TRANSMITTING AGENT OF THE GERM OF TEXAS FEVER.

Up to 1889, ticks were not suspected as having any connection with Texas fever, and nothing of a positive nature was done to elucidate their action in carrying it until the matter was taken up by the Experiment Station authorities of the Bureau of Animal Industry at Washington in that year, with Dr. Cooper Curtice in charge of the investigations, when a careful series of experiments were commenced and continued through several subsequent years. The results of these tests showed conclusively that the disease was conveyed through the agency of the tick, and that, without its presence and aid (except in the case of artificial inoculation), there could be no transmission. So far as is known, the tick, in this country, is the only agent responsible for conveying the parasite of the fever to susceptible cattle after having taken it, along with the blood, from a native immune animal, or from one suffering from the disease, or from a Northern immune after having had the fever and recovered.

Further, that among the different species of ticks experimented with at the Louisiana Experiment Station, the only one which transmitted the germ of the fever, was the common cattle tick of the country, *Boophilus annulatus*.

THE CATTLE TICK DANGEROUS, ONLY, AFTER FEEDING UPON THE BLOOD OF IMMUNE CATTLE, OR THOSE SUFFERING FROM TEXAS FEVER.

The cattle tick being purely the transmitter of the microparasite, it must, of necessity, first procure the organism with the blood from an animal either suffering, or one that has suffered from the disease. It is possible, therefore, for cattle and cattle ticks to live together without any ill-effect, so far as the fever is concerned, because the parasite must be present before the tick can procure and transmit it. Such a condition rarely, if ever, exists, however, although we believe to have seen it recorded that in Porto Rico, Texas Fever did not exist, notwithstanding the prevalence of ticks. Should this record be authentic, the explanation would be, that the disease could not have been introduced into that country.

Then, again, ticks which have attached themselves, and fed upon the blood of horses or mules, will not, directly afterwards, transmit the disease to cattle. The reason for this seems to be, that the blood of these animals will not sustain the germ of Texas fever (it being purely a bovine malady), and, it either ceases to exist in the body of the tick nourished with this blood, or is not transmitted to its progeny, or if present, is in such a non-virile condition as to be innocuous to cattle. Cattle ticks will, however, develop on the blood of horses and mules, and for this reason these animals may be responsible for increasing their numbers, which afterwards may become dangerous, as transmitters, when their progeny find native cattle to attach to and extract their blood.

LIFE HISTORY OF THE CATTLE TICK IN BRIEF.

Briefly, the life-history of the cattle tick may be stated as follows: The fully engorged female (the large tick most frequently observed in cattle) drops to the ground, and in some secluded place, deposits between 1,500 and 3,000 eggs. During the summer months in our State these eggs hatch in from 20 to 30 days into a six-legged form, which, because of its resemblance to seeds of various kinds, or, because of its being the seed of the tick, is popularly known as a "seed-tick." In this condition the small seed-ticks bunch together in great numbers upon grass, weeds, etc., near the place where they are hatched. The passing animal coming in contact with a bunch of these ticks becomes thoroughly infested with them, and they become attached by their mouth-parts to the skin of the host. In the course of from 6 to 10 days, the young six-legged form molts (sheds its skin) and then becomes possessed of four pairs of legs instead of three. In from 5 to 10 days after the first molt, another shedding of the skin takes place, up to which time no sexual characters are apparent, except that the large size of the adult female seems to be foreshadowed. After the second molt, certain characters of the male tick are indicated. At this period mating takes place, and in a few days the life-cycle is complete—the females filled with blood drop to the ground, lay their eggs, and another generation begins. From the time the small six-legged seed ticks attach themselves to the animal, until maturity is reached, there is little disposition on their part to change location, except at the very beginning of their parasitic life, or, perhaps, immediately after each molt, or, in the case of males, to some extent, during their adult existence. Practically, it means the death of the cattle tick, if removed from its host after being once well attached.

The length of time taken by the eggs in hatching, will depend considerably upon the temperature and moisture conditions by which they are surrounded.

ALL SOUTHERN CATTLE NOT IMMUNE TO TEXAS FEVER.

Although the greater area of the Southern States has been placed by the Federal authorities in the "tick-belt," or below the Federal quarantine line, there are portions of, probably, all of these States in which the cattle are found to be non-immune, or, susceptible to Texas fever, when exposed to infestation by the cattle tick. It has been observed that portions of our own State, such as some of the alluvial districts, and those subject to overflow and inundation, are free from cattle ticks. And where no ticky cattle have been introduced, the native stock remain free from the disease, but are susceptible to infection when removed to tick-infected pastures. It is an impressive fact, also, that all cotton, corn, rice, sugar, and other cultivated lands, are every year free of ticks until infested cattle are again permitted to occupy them. This point is worthy of the greatest emphasis, in view of the campaign of extermination that is about to be waged against the cattle tick, as, by keeping such areas free of ticks, great assistance will be rendered this important work. It is not, therefore, a question of locality, as used to be supposed, but of an animal harboring the parasite in its blood, and cattle ticks to transmit the parasite, through the medium of their seed-ticks, to one that is susceptible. These are the natural factors in perpetuating the life of the organism of Texas fever, and in the transmission of the disease. But, it is possible, artificially, to infect a susceptible animal by injecting into its system a small quantity of blood taken from one suffering from the disease, or from one that has had it during some part of its life and has recovered, or, in other words, an immune animal.

SYMPTOMS OF TEXAS FEVER.

The symptoms vary according to the actueness of the attack. After an animal has been infected, a certain amount of time elapses before signs of indisposition are observed. This is the period or stage of incubation, which is not always of uniform length, and, in the case of natural infection through the medium of ticks on pasture, cannot, in every case, be accurately ascertained. However, by placing infected seed ticks on a susecptible animal, or by injecting infected blood into its system, it can be obtained; and the records go to show that, in such cases, the period of incubation is about from 8 to 10 days. Then, if the temperature is taken by the ordinary physicians' thermometer at either of the posterior openings in the cow or heifer, it will be found to have risen above the normal height (100.5 to 102.5), and may reach, in the following 8 or 10 days, 105 to 108 degrees, Fahrenheit. Even with so many degrees of fever an animal may not present any very pronounced outward signs of sickness, other than slight dullness and inappetance, and, were it not for the thermometer record, would even pass suspicion. When, therefore, an animal exhibits unmistakable indications of the disease, such as dullness, loss of appetite, cessation of rumination (not chewing the cud), loss of flesh, staggering gait, hurried breathing, harshness of the coat, drooping of the ears, remaining apart from the rest of the herd, the passage of red-colored urine (*haemoglobinuria*), etc., it is more than probable the disease has existed for some time and was unobserved in the earlier stages. In susceptible cattle, as those imported from above the Federal quarantine line, on pasture, the presence of ticks would at once arouse suspicion as to the nature of the ailment, and especially when accompanied by symptoms of an acute fever, such as those above enumerated.

POST-MORTEM APPEARANCES.

The changes taking place in the tissues of the body after death, do not, as a rule, mean much to the stockman who has not had the opportunity of studying pathology. Yet, we believe, there are a few of these changes more easily recognizable, which might be of some assistance in the way of diagnosis:

THE FAT (ADIPOSE TISSUE.)

The fat in the interior of the body has usually a decidedly bilious or yellowish tinge.

THE HEART.

A somewhat constant appearance is that of blood-staining underneath both the covering of the heart, outside, and the lining of the cavities, inside.

THE SPLEEN OR MILT.

In an animal, a steer for instance, weighing 1,000 pounds, the normal weight of this organ is about 1.72 pounds. In an acute case of Texas fever, however, it may be found to weigh two to four times that amount. When an incision, or cut, is made into the substance of the spleen, its structure appears as a dark brownish red mass, resembling "blackberry jam." The engorged condition and peculiar color is due to engorgement with the red cells of the blood.

THE LIVER.

The liver is the organ most seriously involved. It is very much enlarged and congested, and has a golden-yellowish mottled appearance, due to injection with bile, and fatty degeneration of the liver cells. It weighs from three to five pounds heavier than the healthy liver, and is paler in color.

THE BILE IN THE GALL-BLADDER.

The bile is found in considerable quantity, and is very much changed, having been likened unto the appearance of "chewed grass," and can be drawn out in long flat shreds.

THE BLADDER.

This receptacle may be found to contain from one to four quarts of high-colored urine, resembling, somewhat, the appearance of port wine, due to the coloring matter of the red blood cells mixed with the fluid.

It may be stated that the various changes which occur in the animal body in this disease take their origin, or are dependent upon, the destruction of the red corpuscles, or cells, of the blood.

ARE NATIVE SOUTHERN CALVES IMMUNE AT BIRTH?

An experiment was conducted at this Station to test the question of congenital immunity in calves. That is, to find out whether or not they were born immune. And we believe some of the other Southern Experiment Stations have done similar work. The results of these experiments show that resistance to the effect of Texas, or tick, fever, decreases with the age of the animal. Hence, calves up to five or six months old appear to suffer but slightly under blood-inoculation.

The impression at one time prevailed that the calf was born immune to the disease: but the explanation of this apparent immunity would seem to be that the high resisting power of the young animal enables it to pass over the stage of inoculation by the tick without much apparent effect, and it becomes immune before it reaches an age when that resistance is lessened.

CURATIVE TREATMENT.

Up to the present, so far as we are aware, there is no line of treatment that can be considered specific in Texas fever.

In treating animals during the acute stage of artificially produced, or immunization fever, although we have rarely had to resort to medicines, we have obtained satisfactory results from the use of quinine. This medicinal agent was suggested by the fact that the Texas fever germ, and that of malaria, both belong to the *protozoa*, or one of the lowest forms of animal life.

Whatever medicinal treatment is employed should be commenced at the earliest possible moment after the disease has been recognized, and one of the first things to be done is to effectually rid the animal of ticks, both large and small, and place it in comfortable quarters which are absolutely tick-free.

If the bowels are torpid, the condition may be relieved by the administration of a dose of Epsom salts, combined with a moderate quantity of ground ginger, and made into a drench with about two quarts of tepid water. One to one and one-half pounds of the salts and a half to one ounce of the ginger, should be a sufficient dose for an adult animal. Free access to plenty of pure drinking water should always be permitted. Quinine may be given in from one to two drachm doses, three or four times daily if the temperature of the animal remains high—say, from 103 degrees upwards. With reduction of the fever, the dose of quinine may also be reduced. We have found beneficial effects in lowering the temperature, by combining phenacetin with quinine (30 grains of each, or 40 grains of quinine and 20 grains of phenacetin) for two or three administrations. The most convenient vehicle which we have found for either of the above, is syrup; making the dose into a paste and spreading it over the surface of the animal's tongue with a small, smooth, wooden paddle.

In extreme debility, or during convalescence, we have found a mixture of good whisky and the fluid extract of nux vomica a satisfactory tonic and stimulant. One or two drachms of the fluid extract of nux vomica, two to four ounces of whisky, with sufficient water to form a convenient drench, which should be given two or three times a day, as the symptoms indicate.

Good Nursing.

The administration of medicines, however, is by no means all that is necessary. Good nursing is "half the battle." The nourishment should be carefully looked to, and the patient's likes and dislikes, in this particular, closely observed, and, if possible, anticipated; easily digestible nutritious and tempting food being preferable. Owing to the immense destruction of the cell elements of the blood, and the consequent lowering of the vital forces which occurs in this disease, it stands to reason that the food should be nutritious, or, of what might be termed, the tissue-building class.

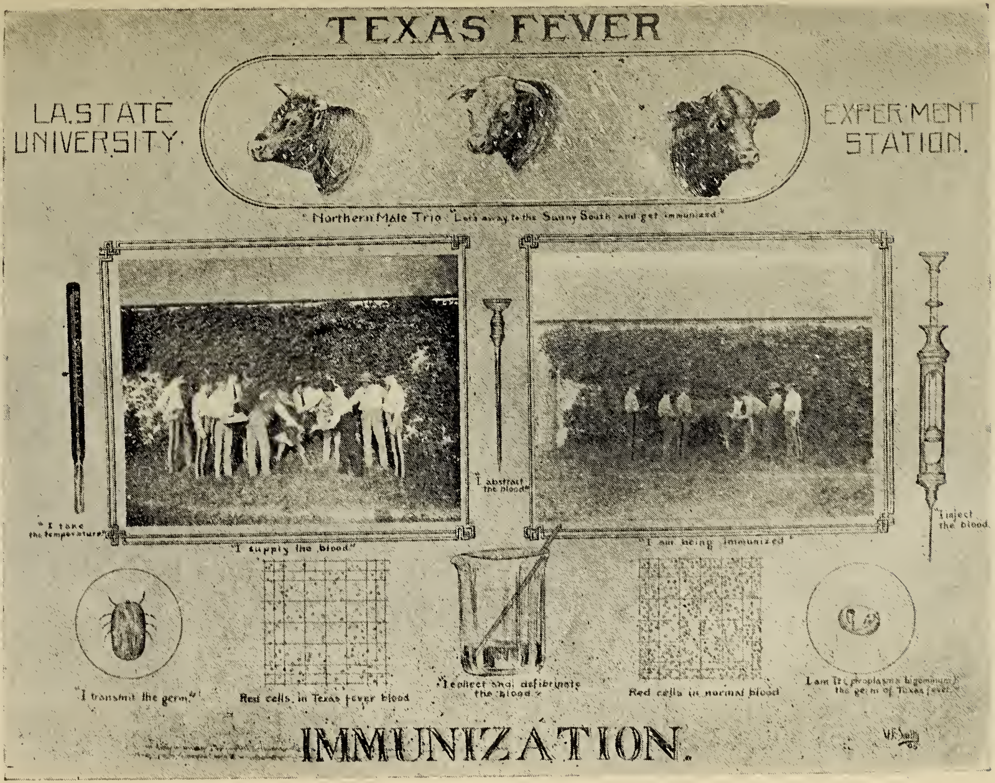
ARTIFICIAL IMMUNIZATION.

The discovery that the tick was capable of transmitting the germ of Texas fever from a Southern native animal to a susceptible one, was of enormous import, but without further investigation and experimentation the knowledge of this fact, alone, would have done but little toward the accomplishment of practical ends.

For some time it had been known to medical scientists that immunity, partial or complete, from certain infectious or contagious diseases could be conferred by producing, through inoculation or vaccination, a mild or non-fatal form of the same disease. This knowledge no doubt led to the experiment of endeavoring to produce Texas fever, artificially, in susceptible animals by the hypodermic (under the skin) injection of blood from a Southern native, knowing that in that blood there existed the germ which the tick was capable of transmitting. The results were satisfactory. For not only was it ascertained that the blood drawn directly from the native was virulent, but that the blood taken from the tick itself had the effect of producing the fever.

Although at first it was found that the mortality was somewhat excessive, a good many animals succumbing to Texas fever as the result of artificial inoculation, subsequent experiments and modifications tended to reduce the treatment to a more sound and practical basis.

Drs. Smith and Kilbourne, of the National Bureau of Animal Industry, in this country, discovered that this disease could be produced with infected blood, and in Queensland, Australia, Mr. C. J. Pond, Director of the Government Stock Institute, and Mr. J. Sydney Hunt, Government pathologist, showed that the disease known as "red water" in Australia, was identical in its nature with our Texas fever, and that if inoculations were made with the blood of cattle which had recently recovered from the dis-


TEXAS FEVER
LA. STATE UNIVERSITY
EXPERIMENT STATION.
"Northern Male Trio." "Let's away to the Sunny South and get immunized."
"I take the temperature."
"I supply the blood."
"I abstract the blood."
"I am being immunized."
"I inject the blood."
"I transmit the germ."
Red cells in Texas fever blood
"I collect and defibrinate the blood."
Red cells in normal blood
I am It (Piroplasma bigeminum) the germ of Texas fever.
IMMUNIZATION.
V. F. Smith

ease, the degree of immunity resulting therefrom was sufficient to enable an animal to resist it in the future.

It should be stated, that in 1897, previous to the general adoption of the blood-inoculation method, other experiments were made. The first one tried was that based upon the use of sterilized blood-serum, as outlined by Dr. John W. Connaway, of the Missouri Experiment Station. This was to determine whether sterile blood-serum (the fluid part of the blood) of immune Southern cattle contained any chemical substance of the nature of an anti-toxin that could be utilized, practically, in bringing about, at least a passive immunity in susceptible animals. The results of this experiment showed, however, that this method gave little encouragement, if any.

A second experiment aimed at immunizing susceptible cattle by infecting them with the germ of the fever through the medium of infected seed-ticks. It was found that success could be attained by this method, but, on account of certain troublesome conditions, it was not considered so practical as could have been desired.

The third series of experiments was with the object of immunizing susceptible cattle by infection with the germ of the disease, through the agency of inoculation of infected blood drawn from a Southern native animal. This is now known as the blood-inoculation method of producing immunity, and which was confirmed by our own Station, as well as those of the other tick-infested Southern States (including Missouri), and has been practiced ever since the results proved so conclusive.

THE ENGORGED TICK AS A SOURCE OF BLOOD FOR INOCULATION PURPOSES.

Before proceeding further with the description of the inoculation treatment, it should be mentioned that this Station conducted a series of experiments (1) to ascertain whether the engorged tick could be used as a source of blood for inoculation purposes; (2) if the blood-engorged female tick might be utilized as a natural "capsule" in which to transport the blood for a distance, and (3) to test the possibility of preserving the infected blood that it might be shipped to other points and still retain its virulence.

The results of these experiments were summarized at the time, and are as follows:

(1) "The blood with which the adult ticks are filled, after maturing on Southern cattle, carries with it the power to produce Texas fever when injected under the skin of a susceptible animal.

(2) Experiments indicate that we may be able to take ticks from recently immunized animals, ship them considerable distances, and utilize them as a substitute for the blood drawn from the vein, where recently immunized animals are not available.

(3) Experiments further indicate that this will give a milder form of the disease, and, afterwards, immunity, just as effectual as when the blood is taken from an immune animal immediately before being used.

(4) We have not, as yet, found any way of preserving the blood drawn from the vein for any considerable time, without it losing its power to produce immunity."

BLOOD INOCULATION METHOD.

Previous to the discovery and adoption of the blood-inoculation method of immunizing susceptible Northern cattle against the ravages of Texas fever, the mortality in these animals ranged, anywhere, from 40 to 90 per cent. This, necessarily, discouraged Southern stockmen in the importation of pure-bred cattle for the purpose of improving their herds; and accounts, mainly, for the scarcity of pure and high-bred stock in the South, up to within recent years.

Consequent upon the use of this artificial method of immunization, however, the death rate from the fever has been enormously reduced. In a bulletin issued by the Texas Experiment Station within the past year or two, a record was compiled showing the percentage mortality of inoculated cattle that had been treated at the Texas, Louisiana, and other Southern (including Missouri) stations, which comprised several thousand head (4,562, up to January 1, 1904), to be only 7.7, and that, too, under various conditions of treatment after they had been placed in their owners' care. This fine record has given increased encouragement to cattle men in the South, with the result, that the immunization work goes on, from year to year, at our own, and the other Southern stations as well.

The time will doubtless come when this treatment will be unnecessary, but not until the South has a sufficiency of purebred immune cattle to meet the demand, or, in the event of complete eradication of ticks from Southern pastures, which may, ultimately, be the case, and which we will allude to later.

The Louisiana Station was among the first to test the blood-inoculation treatment, having commenced to experiment with it in 1898, and the following is a synopsis of the

TECHNIQUE OF THE OPERATION

as practiced by us, as well as of the symptoms in the patient during the inoculation fever.

A point we desire to make clear is, that by inoculation with virulent blood, the animal is given, artificially, a genuine attack of Texas fever; because the germs of the disease are in the infected blood. In other words, we produce, artificially, what ticks would do naturally, but we can control the dosage of the blood in this way, while it is difficult if not impossible, to regulate the number of ticks that might infest an animal on pasture.

THE SUPPLY ANIMAL.

The supply animal is the one from which the infected blood is obtained, either a native or a Northern immune. It should be in good robust health and condition, in preference to one of a delicate constitution, poor in condition and of unthrifty appearance.

ANIMAL TO BE INOCULATED.

Although we have, at this Station, inoculated animals from the age of calfhood to that of mature cattle, experiments seem to indicate that the most suitable subjects are those from about eight to twelve months old, in good flesh, and weighing from about 500 to 800 pounds, in the case of the beef breeds.

Before inoculating, it is well to allow the animals to rest for a few days, especially those that may have come off a tedious railroad journey; and during this time they should be well and carefully fed and kept absolutely free from ticks. In short, the object is to have them in the best possible condition to pass through the inoculation fever satisfactorily.

Obtaining the Blood.

Should the animal be docile, it may only be necessary to secure it in a narrow stall, or even to a post. However, the operation seems more easily performed with the supply animal thrown down and tied.

The hair is now clipped from a portion of the skin of the neck just over the jugular vein. The denuded part is then bathed with an antiseptic solution (3 to 5 per cent. carbolic acid, creolin, zenoleum, or other effective germicidal agent) in order to destroy all septic germs on the skin which might gain entrance to the punctured wound (afterwards to be made) and produce an abscess, or septic inflammation of the vein. The neck of the animal is now straightened and tensed, and a piece of good strong cord or small rope (one-quarter inch) tied round its base sufficiently tight to check the flow of blood and raise the vein. A small trocar and canula, or hollow sharp-pointed needle, which has previously been sterilized, or disinfected, is then inserted into the distended vein and is directed up the vessel toward the head. As soon as the needle enters the vein, the blood passes through it into a sterilized glass, or other receptacle; and when sufficient blood has been extracted, the needle, or canula, is withdrawn, the rope around the neck loosed, and the wound bathed with antiseptic solution.

Preparing the Blood.

To prevent the blood clotting, after it has been withdrawn, it is immediately stirred, slowly, with a thin glass rod, which has been disinfected, until as much as possible of the clot has collected on it, and it is then withdrawn. The remaining defibrinated blood, or a part of it, is then drawn up into a clean hypodermic syringe, and the quantity to be injected gauged by a small screw-regulator on the piston.

Injecting the Blood.

The animal to be inoculated is prepared by clipping the hair from off a portion of the skin—about the size of the hand—behind or a little above the point of the elbow, on the side of the chest (any part where the skin is loose and thin, will answer). This is disinfected as in the case of the supply animal. The skin is then drawn out between the thumb and forefinger of the left hand, and an incision made through it with a narrow, sharp-pointed knife or lancet to allow of easy introduction of the hypodermic needle, care being taken not to injure the chest-wall. If the needle is a very strong one, it may not be necessary to use the lance. The syringe is now attached to the needle and the required amount of blood injected under the skin. After withdrawal of the needle, the part is again lightly bathed with the antiseptic solution, and the surgical part of the work is completed. Success here depends very largely upon the antiseptic precautions taken in the operation. Consequently, all instruments and utensils, the hands of the operator, and the operative area of skin, should be thoroughly disinfected.

Dose of Blood.

The standard amount of blood used at this Station for some time, has been one cubic centimeter (about 16 drops) for animals of any age. Latterly, however, it has been our custom to administer a second dose of two cubic centimeters, after recovery from the second fever period (referred to later on). The object here is to increase, if possible, the degree of immunity before the animal is exposed to ticks. After this second injection of blood, the patient is kept under observation for ten days, or so, longer, and the temperature taken to watch the course of the fever, should there be any.

We have previously stated that the blood before injection was stirred to remove the clot (defibrinated). This is usually done, when a number of animals are to be inoculated, to prevent clotting before the work is completed. In the case of a single animal, however, or even two or three, the blood may be drawn directly from the vein of the supply animal into the hypodermic syringe and injected immediately into the other animal or animals, while it is still warm and fluid.

Fever Reaction.

For the first eight or ten days, with some exceptions, no rise of temperature takes place (period of incubation). About the tenth day, signs of fever are noticeable by the use of the thermometer. There may be two, three, or more degrees above the normal. The fever continues for about eight or nine days, but in some instances, may not exceed four days, while in others it may continue fifteen days. This is known as the primary reaction, or first stage of the fever. During this stage we have known the temperature to reach 108 degrees Fahrenheit, and over.

After this period there is a remission; and from about the twenty-fifth to the thirtieth day, after inoculation, there is another rise which lasts about seven to ten days. This is the secondary reaction, or second stage of the fever, which may differ somewhat from the primary in being more irregular in its course. The temperature should be taken morning and evening.

Should the blood of the animal be examined during these fever periods—by an instrument termed the haemocytometer—for the purpose of noting the number of cells in a given quantity of blood, it will be found that they will have been considerably reduced in number, owing to their destruction by the fever germ, which appears to be particularly active at these stages.

After perfect recovery from the second period of fever, which might be placed at from fifty to sixty days from date of inoculation, the animal may be exposed to mild tick infestation. But it seems much safer not to subject newly inoculated animals to extreme conditions for at least one year.

Although inoculation may be performed at any season of the year, the best time in our climate is during the late fall or early winter months. This prevents a too sudden gross infestation with ticks when the animal is turned on to pasture, as would, naturally, be the case during the summer months.

Care of the Animal During the Inoculation Fever.

The care of the animal during the course of the inoculation fever is of the utmost importance. The quarters should be absolutely free from ticks, and they should be comfortable in every way. Exposure to climatic severities, while the animal is the victim of the fever, is likely to be succeeded by untoward results. The food, as previously alluded to, should be nutritious, as it is desired to furnish the elements that will keep building up and restoring the blood and other tissues of the animal body that are being broken down as a result of the disease.

It has been the custom with our Station to feed the animals three times per day, with a moderate quantity at each feed, of concentrates such as crushed corn and oats mixed, with hay, when the animals were not able to be turned out to graze. Where a convenient oat patch can be made available, pasturing on it during the day will be found quite beneficial, in not only nourishing the cattle, but keeping the bowels in good condition. In this case, concentrated food may be given morning and night only.

There is no special ration that might be suggested. Any good sound concentrated feeding materials that are available, so long as they are nutritious, will be suitable. The animals should not be surfeited with too much food, but it should be rather allowed in moderate quantity. And, as before stated, pure drinking water should be accessible at all times; and a little salt will be found beneficial.

COMPLETE IMMUNITY NOT CONFERRED BY ARTIFICIAL INOCULATION.

Having successfully passed through two periods of fever before being exposed to ticks on pasture, the animal seems to have obtained a sufficient degree of immunity to withstand the ill-effects of further inoculation by the ticks, provided the latter are not so numerous as to transmit the germs in excessive numbers and cause a relapse. Hence the value of having the animal ready to place on pasture at a season of the year when seed ticks are few, but sufficient to keep up the inoculation until absolute immunity is reached. In other words, artificial inoculation gives the animal a start toward immunity, and the ticks keep it up until it is immune. But it should be arranged so as to have the tick inoculation gradual, and not sudden and excessive, as would be the case in summer, with gross tick infection of pastures.

RECENTLY ARTIFICIALLY IMMUNIZED ANIMALS SEEM TO SUFFER LESS ON PASTURE WHEN RUNNING WITH NATIVE, OR OTHER, PERFECTLY IMMUNE CATTLE.

It has been our experience at the Louisiana Station, that when a number of recently immunized cattle are placed upon a ticky pasture alone, they seem to suffer more severely from tick-inoculation than when allowed to run with native animals. The reason for this appears to be, that the germ of the fever becomes more virulent when perpetuated in ticks bred upon imperfectly immune, or partially susceptible, cattle. It would seem that when being passed, from time to time, through the blood of native or perfectly immune stock—which become highly resistant to its effect, the germ loses, to a considerable degree, its virulence. That is, it becomes attenuated or weakened, and afterwards, when inoculated into the circulation of the recently immunized animal by the tick, does not produce such an acute form of the fever. But, when there are no immune animals present, along with those recently inoculated, to modify the virulence of the germ, the latter may suffer considerably, on account of increased potency on the part of the organism. Hence, we would suggest that cattle, recently inoculated and turned out at the proper time, should be permitted to run along with native, or immune, animals for the reasons just advanced.

ERADICATION OF THE TICK.

Great as has been the boon of artificial immunization of susceptible cattle to the Southern stockman, the ideal situation will not have been reached until the cattle tick has been eradicated from the Texas fever belt of the Southern States.

By the aid of the inoculation process, alone, our stock owners have been enabled to import pure-bred cattle from Northern States to improve their herds, in spite of the presence of the tick. But the latter still remains with us, and so long as it does so, the Southern feeder of beef animals will never be placed upon the same footing with his Northern neighbor, so far as the advantages of the great markets of the North and West, at any and all seasons of the year, are concerned; and this, too, solely on account of the tick.

True, Southern cattle for immediate slaughter can now be shipped north of the Federal quarantine line, but only during a very short period of the winter season, and then have to be placed in special sections of the stock yards provided for Southern cattle, which tends to interfere with fair competition.

Again, the Southern raiser of show cattle is prohibited from competing with the Northern exhibitor in the great State, National and International expositions, which he ought, and would be able to do, were it not for the influence of the tick.

But, even in the case of our native cattle, and from a local economic standpoint, the tick is perhaps the greatest enemy of our cattlemen. Because, although our Southern animals may be, and the majority are, immune to Texas fever, the constant irritation produced by, and the blood-sucking proclivities of, the tick, enormously retards development in the animals, in the direction of growth, fattening and milk-giving qualities. Looked at from every point of view, therefore, it will be seen that the great incubus to a prosperous cattle industry in the South is the common cattle tick.

Appropos of our remarks with reference to shipping fat cattle to the Northern markets, it might be instructive to refer here, to a demonstration made by this Station two or three years ago.

DEMONSTRATION IN FATTENING CATTLE FOR THE NORTHERN MARKET.

To test the question as to whether Louisiana could fatten a carload of steers, on home products and by-products, for the Chicago market, and compete with those fed in the corn belt (which was not thought feasible by some feeders in that section), the Station purchased a lot of high-grade Aberdeen Angus calves in the neighborhood of Clinton, Ill. Seventeen steer calves, the remainder being heifers and one bull, were selected for the demonstration. Being susceptible, or non-immune, all of the animals (some thirty-four head) had to undergo the immunization process, which they did without loss, except in the case of a steer calf, which succumbed to an acute attack of congestion of the lungs during convalescence from the inoculation fever. On January 1, 1904, a carload of sixteen steers left the Experiment Station at Baton Rouge, averaging two and one-half years, and 1,325 pounds in weight. They were six days and nights on their journey, and when sold in Chicago, averaged 1,251 pounds. They brought $5.65 per hundredweight, topping the market on the day of sale by 40 cents. They were purchased for New York account, and when butchered, dressed within a fraction of 59 per cent.

Although this was an excellent showing, had it not been for the tick, which infested these animals from time to time during the convalescent and fattening periods, there is no reason to doubt that the gradual and ultimate gains made in weight would have been considerably greater.

THE ERADICATION OF TICKS FROM PASTURES IN THE SOUTH

Is a matter which has occupied the attention of several of the experiment stations for some time. Dr. Tait Butler, in North Carolina, has, already, by a system of tick starvation and rotation of pastures, freed several of the counties of that State of ticks, and brought them above the Federal quarantine line, so that the cattle now raised in them have free access to the Northern markets at any season of the year, much to the advantage and gratification of their owners.

In our own State, Prof. H. A. Morgan, late Station Entomologist, and now Director of the Tennessee Agricultural Experiment Station, has, based upon a careful study of the life-history and habits of the cattle tick, suggested a method of tick eradication, which we think will, so far as our latitude is concerned, prove of incalculable value in revolutionizing our cattle industry.

The results of Professor Morgan's investigations, while in Louisiana, have already been published as Louisiana Experiment Station Bulletin, Second Series, No. 82, and to which reference is commended for detailed information on the subject. We have, however, taken the liberty of reproducing that part of the work which deals with two methods suggested, in order to render this publication the more complete and comprehensive. These are as follows:

DATA AND PASTURE ROTATION. REMEDY I.—(a).

"In the study of the development of the Texas fever cattle tick during the summer months it was found that the time required for seed ticks, after infesting animals, to mature into engorged females and drop to the ground for egg deposition was a little less than the time required for a female after dropping to lay eggs, and these eggs to hatch. Therefore infested animals might be cleaned of ticks by being placed in a tick-free field, upon which to drop all their ticks before eggs from females dropped the day the animals were placed in the pasture would hatch. The time between the droping of the ticks and possible reinfestation was of too short duration for this plan to be practicable in the face of slight developmental variations due to changes in temperature or other conditions. Experiments were conducted in order to determine if a wider range of time between these important suggestive remedial periods did not exist and thus develop a remedy easily within the range of the average farm operations of the State. Continuing the breeding experiments through every month in the year, it was found that eggs deposited the latter part of November, and in December, January, and February, did not hatch until late March, April, or early May, and that the longest period of development of the tick (from seed tick to full engorgement and period of dropping) upon cattle during these months was forty days, thirty-five being in most cases ample for the development and dropping of every tick. It thus became easily possible to place infested animals upon tick-free areas during late November, December, and January, have them drop every tick, and run no risk of reinfestation, as eggs did not hatch under the prevailing temperature of these months.

DATA AND PASTURE ROTATION. REMEDY I.—(b).

"The next phase in the development of a practical remedy was the determining of the length of time necessary to starve ticks out of a pasture when all hosts (cattle, horses and mules) were excluded. Experiments during the summers from 1897 to 1904, inclusive, showed that about one month was necessary for the laying and hatching of eggs and that seed ticks could endure as long as two months in summer without food. For example, if all hosts of the cattle tick were removed from a pasture on June 1 this pasture would be tick free by early October.

"The fall and winter months, though a decidedly opportune period for ridding animals of ticks, were found least effective as a period for cleaning pastures by excluding cattle tick hosts. Eggs deposited in late fall may not hatch until the next March or April, and seed ticks may live without food from late September until the middle of the following April. It will thus be seen that more time is required during the late fall and winter months to deposit and hatch tick eggs or to starve out seed ticks than is necessary during midsummer to effect both operations.

"With this information a remedial application may be perfected to meet the conditions upon the farms or plantations of the South. Pastures may be divided so that from a portion of them all animals (cattle, horses and mules) upon which the Texas fever cattle tick develops may be excluded from June 1 until late fall in order that the animals when cleaned of ticks may have a tick-free field in which to be placed. To be cleaned the animals may be placed, not earlier than the middle of November, in a corn or cotton field from which the crop has been removed, and there kept until the ticks have dropped (thirty-five or forty days). In no case should they have access to the pasture from which they have just been taken, as animals may become infested during a warm spell of the winter months with seed ticks which hatched in September or early October. (Seed ticks hatched September 29, 1903, remained alive without food until April 10, 1904). As soon as all ticks are dropped the animals may be removed to the tick-free field, or they may remain longer without danger of reinfestation if the corn or cotton field provides sufficient pasturage. Not later than February they should be placed in the tick-free field to be fed the hay crop gotten from this area the previous season. Upon this tick-free area they may be kept until sufficient time has elapsed to destroy the ticks by starvation in the pasture from which they were removed into the corn or cotton field the fall previous.

"FEED-LOT" METHOD OF RIDDING CATTLE AND OF CLEANING PASTURES DURING SUMMER. REMEDY II.

"It should be remembered that not all farms nor all fields of individual farms lying below the National quarantine line are infested with the fever tick. Parishes of Louisiana devoted to sugar cane and rice culture are practically free from ticks. Many cotton plantations are also exempt, and those parts of all farms throughout the South upon which no cattle have been from June 1 until October 1, or later, are also tick-free. These areas may be advantageously used in eradicating the fever tick from contiguous ones.

"The 'feed-lot' method of cleaning cattle is based upon the fact that the parasitic period (from attachment as seed tick to dropping to ground as a fully engorged female) of the fever tick is not more than forty days; less in summer. In this method a portion of ground is set apart, half of which is of sufficient size to accommodate the number of cattle on hand. The area selected should be convenient to plenty of feed and water. Surround and divide the lot with a double fence (8 to 10-foot space). Feed the cattle for twenty days on one side, then remove them to the other for fifteen or twenty days longer. Every female tick will have dropped, and the cattle may then be placed upon such field or pasture as may be tick-free and available." (Male ticks may remain on cattle two or three weeks longer, but are harmless in the absence of females.) "By this method entire farms may be cleaned during a summer period of not exceeding four months In the early spring select a field with water and shade available to be devoted to broadcast sorghum, corn or millet, or all three. On June 1 fence off the feed-lot (within the forage field), in which place all the cattle of the farm, and feed and rotate as described above for forty days. At the end of this period the cattle may be turned into the field of sorghum, millet or corn, and there pastured until October 15 or November 1, by which time all fever ticks upon the entire property outside of the feed-lots will have perished.

"After the animals are removed the feed-lots should be immediately plowed and thoroughly cultivated, and their edges completely sprayed with crude petroleum, zenoleum solutions, or other substances destructive to tick life.

SUMMARY.

"1. The North American cattle tick has been bred upon cattle, horses and mules. Horses and mules are not continuously infested when upon ticky pastures as are cattle.

"2. Sheep and goats run upon pastures, scatter bunches of seed ticks and reduce possible infestation of cattle upon the same pastures.

"3. The excessive tax of gross infestation of ticks is not only shown by the great loss of flesh of animals attacked, but in the slower development of ticks on animals intensely infested.

"4. In connection with the two pasture methods suggested for the eradication of the fever tick, the periods of greatest importance in the life of this tick are, (1) the combined egg laying and incubation, which takes place upon the ground of the pasture, and (2) the development of the tick upon cattle (from the time the seed ticks are collected from the pasture and attach, through the two molting periods, to the engorgement and dropping of the females). Eggs hatch readily in from twenty to thirty days from May until early October. Those deposited in the latter half of November, in December, January, February, and early March, hatch in April and May; earlier in exceptionally open winters. Ticks develop upon cattle in from about nineteen to thirty days in summer, and the longest winter development upon cattle was found to be forty days.

"5. More eggs are deposited in summer than in winter. Many females succumb to the cold before depositing half as many eggs as females of the same size would deposit in summer.

"6. Seed ticks possess remarkable vitality, having been found to be able to exist without food as long as two months in summer and over six in late fall, winter, and early spring.

"7. From a study of the life and habits of the fever tick, two plans have been developed for its eradication: (1) a pasture rotation system, utilizing June, July, August, September, and October to starve out the tick from pastures by excluding cattle, horses, and mules; (2) the adoption of the feed-lot method within a sorghum, corn, millet or other forage field conveniently located for water and shade.

"8. Animals south of the quarantine line may, any time during the year, be absolutely cleaned of female ticks in forty days or less by the feed-lot method.

"9. Seed ticks hatched in late September and October, living as they can as long as six months, may infest cattle during any warm spell from late September until April.

"10. While a number of substances are of great value in reducing tick-infestation of animals, they are attended with some loss, considerable expense, and much worry, and can not be relied upon for complete eradication except when associated with the pasture rotation remedy. Many substances used to lessen tick infestation irritate the skins of animals and lengthen the period of development of ticks which survive the effect of the application."

CAN THE CATTLE TICK BE EFFECTUALLY EXTERMINATED FROM SOUTHERN PASTURES?

In answering the query we have made for ourselves, we would say, that with individual effort, only, No! With united action, Yes!

If the work of Morgan and Butler, and possibly some others, of totally eradicating ticks from restricted areas, which, in the case of North Carolina, amounted to several counties, means anything, it is, that it is possible to extend the good work, along similar lines, to take in the entire tick-infected sections of the Southern States. But, there must, of course, be concert of action and uniformity of effort on the part of every one concerned. Fortunately, the ultimate success of the plans suggested has appealed to the United States Department of Agriculture, and Mr. Hunter, under the Bureau of Entomology, in co-operation with all of the States affected by the cattle quarantine, and who is in charge of the work, is now engaged in pushing the biologic investigation of the tick, which we hope is the beginning of great things for our Southern cattle industry.

Although the Government has already taken hold of the matter, it may not be out of place to quote a resolution passed by the American Veterinary Medical Association at its annual convention held in Cleveland Ohio, in August last, as it shows, in brief language, the importance of this great work:

''Whereas, the Southern cattle tick (*Boophilus annulatus*) and the resulting Federal quarantine restriction on the movement of Southern cattle, is the greatest obstacle to the growth of the cattle industry of the Southern States, and

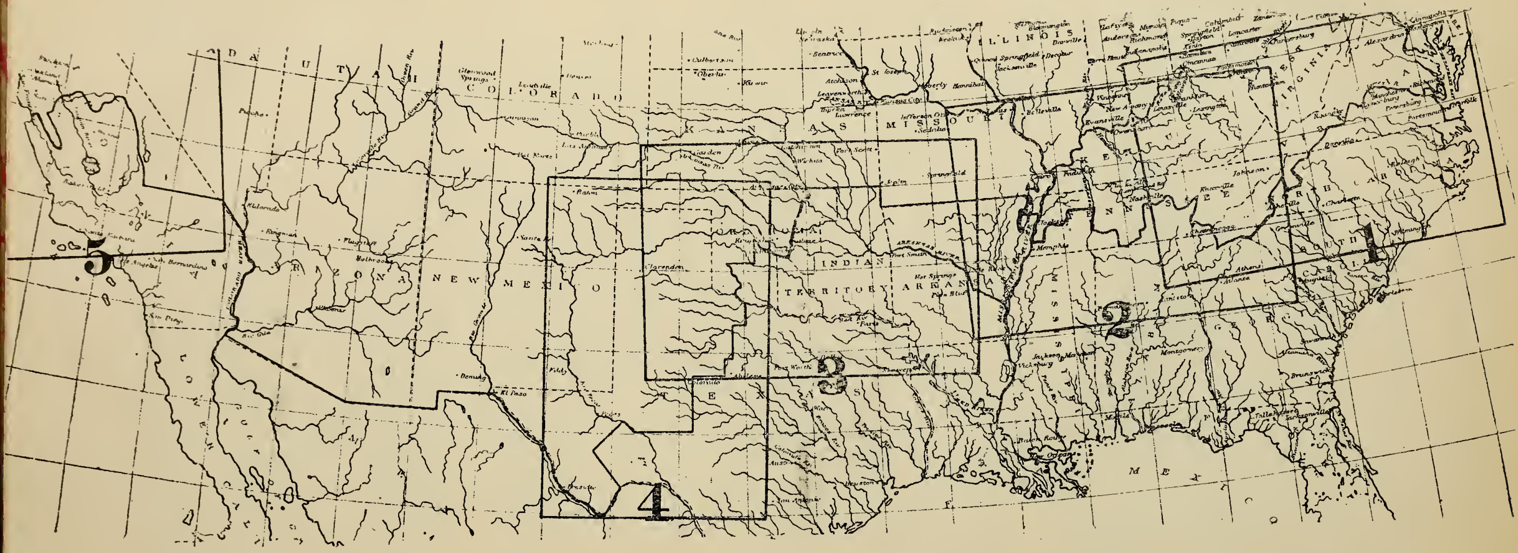
''Whereas, the work of tick extermination in some of the Southern States demonstrates that it is perfectly feasible to eradicate the cattle tick pest, and

''Whereas, the Federal Bureau of Animal Industry has successfully conducted measures to eradicate other diseases when affecting or jeopardizing the cattle interests of other sections of the country; therefore be it

''Resolv*e*d, That it is the sense of this Association that the time has arrived for active and substantial Federal assistance to the Southern States in their efforts to exterminate the greatest present menace to the cattle interests of a large part of our country.''

With the eradication of the tick, Texas fever, that bane of the Southern raiser of improved cattle, will be a thing of the past, and instead of embargoes, in the form of quarantine restrictions against the free movement of our cattle northward to the great markets, all barriers will be lowered, and our stock will be granted a free entry at all times to whichever mart suits best the convenience of the owner.

What a future for the cattle industry of such a magnificent cattle-growing section of the country! What an object to be attained! It is possible of realization! Let us all work together as a unit for its accomplishment. For, apart from the fact that the tick is the conveyor of the germ of Texas fever, it should be strongly borne in mind that it is also a parasite on our cattle, and the most baneful in its effects that the Southern cattle raiser has to contend with.



EXPLANATION.—The Texas Fever section of the United States is south of a zigzag line, shown in the map, beginning at the extreme northwest corner of the illustration; passing along the southern boundary of Arizona, and down to a point on the southern boundary of Texas. It afterwards passes up to the northern line of the Indian Territory; across the southern boundary of Missouri; then through a portion of Tennessee and North Carolina and up in a northeasterly direction through Virginia.

The numbers shown on the map have no significance here.

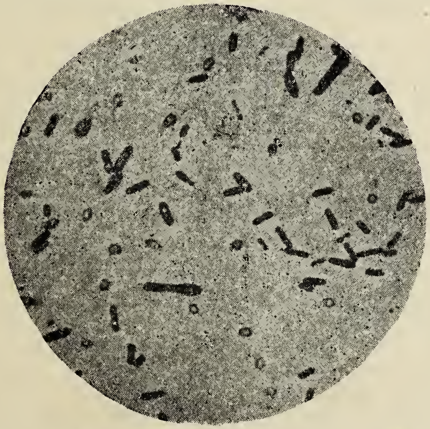
La. Bulletin No. 85. March, 1906

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

BATON ROUGE.



Germs of Black-Leg. Magnified About 950 Times.

BLACK-LEG.

W. H. DALRYMPLE, M. R. C. V. S.

BATON ROUGE:
THE TIMES, OFFICIAL JOURNAL OF LOUISIANA.
1906.

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The Bulletins and Reports will be sent free of charge to all farmers, by applying to the Director of the Stations, Baton Rouge, La.

BLACK-LEG.

W. H. DALRYMPLE.

From time to time the Veterinary Department receives requests for information regarding "Black-leg," a disease quite fatal to young cattle frequently in the best of condition, but which does not appear to be recognized by many, and it is for the purpose of supplying to our cattle owners something like accurate data on the subject that the Station publishes this short bulletin at the present time. We are not prepared to say that this disease is of more frequent occurrence than heretofore in the State, but, on account of the greater tendency on the part of our people to raise and own animals of better breeding, and, in consequence, of greater value, losses occurring in their stock may be receiving more attention, as to cause, with the result that the trouble is being more frequently recognized, rather than becoming more frequent.

The value of young "scrub" cattle is relatively so inconsiderable that when a few of them die on the farm little thought is taken of the probable cause of death, and, therefore, no investigation is made to endeavor to discover it. Black-leg may have been at the bottom of many of such fatalities in the past, unrecognized, and because of the proper sanitary measures not having been taken to destroy infection in the bodies of the victims, the disease may, no doubt, have become established in certain localities, laying the foundation for the cases in the more valuable animals, and which, because of their greater value, has caused owners to seek more information regarding the fatal ailment. Fortunately, although the disease is a very fatal one among young cattle, it can be almost wholly prevented by vaccination. In fact, statistics recorded by the National Department of Agriculture at Washington go to show that out of 1,500,000 animals vaccinated, the loss reached only about one-half of one per cent.

Besides being known as black-leg, the disease has other names, such as black-quarter, quarter-ill, symptomatic anthrax, symptomatic charbon, etc. To avoid confusion, however, we will confine ourselves to the first name, black-leg. The use of the terms, symptomatic anthrax and symptomatic charbon, has led to a good deal of misunderstanding and error in our State, so far as this disease is concerned, because, having anthrax or charbon as a part of the name, many have been led to think that the disease was genuine anthrax or charbon. Some writers on veterinary medicine use the terms, symptomatic anthrax and charbon symptomatique (the French), because of its apparent resemblance to the external appearance of that disease, especially a swelling that is usually to be found in those parts of the body thickly clothed with muscular tissue. But since bacteriology has assumed the rank of a most import science, it has been found that the two diseases are separate and distinct and produced by entirely different organisms or germs. So that, in reality, the one has nothing at all to do with the other; the only similarity of importance being, perhaps, that both are rapid and fatal in their effect. For the information of our German settlers we may mention that this disease is known in their language as "Rauschbrand."

CAUSE.

Black leg is a rapidly fatal infectious disease of young cattle, and is caused by a spore-bearing organism, the *bacillus Chauvoei.* Spring and fall are said to be the most favorable seasons for the development of the ailment, and cattle between the ages of six and eighteen months are the most liable to become affected, although partial susceptibility seems to remain up to about four years.

The manner of infection is by indirect contact with the germ on infected soil, the organism gaining entrance to the body through abrasions of the skin, and, perhaps, in rare cases, through the mucous membrane of the mouth and other parts of the alimentary canal. The wounds or abrasions are generally quite minute in size, but sufficiently deep to penetrate through the skin into the tissues underneath. Punctured wounds, such as those received from barbed wire fences or from stubbles or briers in pasture, seem to be the most likely method of infection, and correspond somewhat closely to the only manner in which the disease may be produced artificially—viz., through injection of the virus hypodermatically.

SYMPTOMS.

The disease is easy of recognition on account of the symptoms being quite characteristic. It is characterized, first, by the symptoms of a more or less intense fever and by the appearance of a specific tumor, or swelling, upon the body, neck or upper part of the limb above the knee and hock, causing stiffness or lameness. This swelling is almost constantly found in the thick flesh or muscles of the parts mentioned. It consists of a progressive inflammatory enlargement, of firm and uniform consistence, rapidly extending in area and depth, and later becoming insensitive, crepitant and resonant, or, in other words, the swelling emits a crackling sound when the hand is passed over it. This crepitant sound is due to the collection of gas in the affected flesh, and which is produced by the germs of the disease. When the swelling is cut into, a frothy, dark red fluid escapes, and the flesh of the swelling is dark in color, with the appearance of being mortified.

With few exceptions, the disease terminates fatally, death usually occurring in from twelve to thirty-six hours after the first appearance of the symptoms.

TREATMENT.

With regard to treatment, it may be said that curative (?) agents are of little or no avail—prevention being the only satisfactory method of attacking the disease. This may be divided into the following, viz., hygienic and preventive or protective.

HYGIENIC.

This aims at destroying or preventing the spread of infection in all places where cattle are kept, and the second, to endeavor to fortify the systems of susceptible animals against an invasion of the black-leg germs.

Similar to anthrax (charbon) in this respect, black leg infection is largely spread from the dead animal through the medium of carnivorous animals and birds (dogs, buzzards, etc.), or omnivorous animals (hogs) attacking the carcasses and carrying the germs broadcast, or the victim may be skinned for its hide, or incisions made into the swellings to "doctor" the patient, and the infection scattered from the cuts made in the swelling. These and other processes naturally assist in disseminating the virus or poison. In a circular on this disease, issued by the United States Department of Agriculture, at Washington, D. C., the following paragraph is italicized in order to give it emphasis: "It is, therefore, of the utmost importance that cattle owners in the infected districts be made to realize that an animal affected with black-leg may be the cause of large subsequent losses from the same disease, perhaps not immediately, but within a period of years to follow, and it can not be recommended too urgently that they make every effort to reduce the danger by taking adequate measures to destroy, as completely as possible, this source of renewed infection."

The best method of disposal is to cremate or burn the dead animal, and in order to insure complete destruction of it, it should be placed on a couple of logs, or over a trench, and plenty of dry wood heaped around it. A few quarts of coal oil should then be poured on, and fire set to it. It has been claimed that in some parts of the State it is not possible to obtain sufficient wood for the purpose of burning up the bodies of animals that have died from infectious diseases, such, for example, as in certain parts of Southwest Louisiana. This section, however, has the advantage of having oil in abundance, and an inexpensive and convenient method is, first, to dig a trench of sufficient size, and placing in the bottom of it a quantity of old sacking to act the part of a "wick," then saturating the sacking by directing a pipe from a barrel filled with oil into the trench. By regulating the flow of oil, a continuous flame may be kept up until the carcass is completely consumed, and at a minimum of cost where such a method can be conveniently undertaken.

It is important that the carcass be entirely destroyed. The place, also, where the body has lain should be subjected either to heat or it should be sprinkled with some powerful disinfectant, such as crude carbolic acid, creolin, zenoleum, lime, or other agent.

Unfortunately, there has as yet been no sure method found of completely eradicating black leg infection from a pasture.

PREVENTIVE OR PROPHYLACTIC.

It is to the division of prevention which we term prophylactic, combined, necessarily, with the hygienic, that we have to look for the most gratifying results, which are to be found in preventive vaccination of susceptible animals, and for which we are indebted to the discovery of Arloing, Cornevin and Thomas, that animals could be protected against black-leg by injecting them with more or less virulent material obtained from the tumors of animals that had died of the disease. The beneficial results of this treatment may be appreciated by the reference made in our preliminary remarks concerning the record of the United States Department of Agriculture. And, further, it may be mentioned that during the fiscal year ending June 30, 1904, the Department distributed over 1,000,000 doses of black-leg vaccine, which were used and reported upon by over 10,000 persons with highly satisfactory results, the mortality reaching only 0.44 per cent.

Black leg vaccine is now a commercial commodity and may be obtained from, or through, any of our large wholesale druggists, directions accompanying the material, or it may also be had, free of cost, by making application to Dr. A. D. Melvin, Chief of Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C., and subscribing to certain stipulated conditions.

In conclusion it may be stated that, although sheep and goats, as well as cattle, are susceptible to black-leg, they are rarely attacked by it, the disease being most common and destructive in the young bovine species.

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Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

BATON ROUGE.

A Louisiana specimen of our "Great American Cereal."

OUR AVAILABLE STOCK FOODS.

W. H. DALRYMPLE, M. R. C. V. S.

BATON ROUGE:
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1906.

LOUISIANA STATE UNIVERSITY
AND
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OUR AVAILABLE STOCK FOODS.

W. H. Dalrymple.

What to feed and how to feed it, in order to obtain the most satisfactory results at the least possible cost, has been and always will be, one of the most important problems confronting the feeder of live stock.

Louisiana is by no means behind her sister States in the matter of stock-food-production, either as to concentrates or roughage, and it is the object of this bulletin to endeavor to draw our stockowners' attention to what we have available, both in direct products and by-products, and how it may be intelligently utilized to the best advantage.

It is hoped that we have been fortunate enough to be able to present the information contained in the following pages, in acceptable form, and in an intelligible manner, as the subject is one of the greatest import to the live stock interests of the State.

Making lespedeza hay on a Louisiana farm.

Before entering upon an enumeration, etc., of our available feeding materials, it will be necessary to refer, briefly, to a few of the technicalities connected with the principles and practice of feeding, which the feeder ought to understand in order that he may be able to intelligently apply the principles to the practice; or, in other words, know what he is doing; why he is doing it, and the results it is reasonable for him to expect.

In the first place, the body of the living animal contains, or is made up of, a number of substances very similar to those found in plants, such as water, nitrogenous matter or protein, fat, and mineral matter. In the act of living, these materials in the animal body are constantly being used up, and if not continually supplied, through the medium of the various plant food products, the animal will gradually become emaciated and, ultimately, die.

In the case of herbivorous animals, such as the common domestic animals of the farm, which all, more or less, subsist on herbage or plants of one kind or another, their food contains an additional group of substances to those mentioned, viz., carbohydrates, or nitrogen-free extract, of which starch and sugar are good examples.

Before being able to build up and nourish the body-tissues of the animal, which are composed of the substances alluded to, the feeder ought to be familiar with the composition of the food materials which have to accomplish the work. These may be mentioned as follows:

(1) Water.

Everyone who feeds stock may not be altogether conversant with the fact, that all food stuffs, no matter how dry they may appear, contain a considerable amount of water, or what may be termed, moisture.

In grains and dried or cured fodders, like hays, it is estimated at about from 8 to 15 per cent. of the weight of the food; in the grasses, and other green foods, it may run as high as 80 per cent.; while in roots, such as turnips, ruta bagas, etc., 90 per cent. of their weight may be reached.

Although water is a very essential part of the animal body, constituting about from 40 to 60 per cent. of its live weight, the value of a food material is not considered from the standpoint of the amount of water contained in it, but is based upon its dry matter, or what the chemist terms, its water-free content. For example: If 100 pounds of oats, of average sample, are subjected to slow heat, not sufficient to burn them, and afterwards weighed, they will be found to have lost 11 pounds, which is the weight of the water they had previously contained. The remaining 89 pounds represents the dry matter. Hence, In computing a ration for an animal, only the water-free substance is considered.

(2) Ash or Mineral Matter.

This can probably best be understood by stating that that which remains over of a sample of foodstuff, after its organic matter has been completely burned, is the ash or mineral matter, that had been taken up and stored by the plant during the period of its growth. This ash in the food, which is composed largely of lime, potash, magnesia, soda, iron, etc., serves to supply the mineral matter required by the animal to build up its bony, and other structures.

Foods in general, however, contain a sufficiency of mineral matter for the demands of the animal, with the possible exception of common salt (chloride of sodium), which usually has to be supplied.

(3) Protein or Nitrogenous Substance.

The term protein is from the Greek, and means "to hold the first place." Its name is derived from its occupying the first or most important place in relation to the albuminous principles. The term is here used, however, to characterize the constituents of feeding stuffs containing nitrogen. Or, in other words, the nitrogenous compounds of stock foods, both vegetable and animal, are, for the sake of brevity and convenience, designated as a class by the term, PROTEIN.

Belonging to this class of substances is the white of egg, generally termed albumen. There is also vegetable albumen which closely resembles the white of egg, and like it, is coagulated by heat. Another is gluten, found in the wheat and other grains; another, legumin, the nitrogenous element contained in such plants as peas, beans, alfalfa, lespedeza, clover, etc., belonging to the order, Leguminosæ. The fibrin of meat, and the casein of milk, are both examples of this nitrogenous substance, and cotton seed meal contains quite a high percentage of it.

The use, or function, of protein in the food, is to build up and repair such parts of the animal body as the muscles (no other class of food constituents can form lean meat), tendons, internal organs, the blood, the skin, etc., and it also assists largely in the formation of milk.

(4) Nitrogen-Free Extract or Carbo-Hydrates.

As the first of these names would imply, this fourth group of substances does not contain any nitrogen, and according to the second, it contains carbon, hydrogen and oxygen, with the two latter elements in the proportion to form water, that is, two of the former to one of the latter (H_2O). Examples are, starch, sugar, and the fiber or woody part of plants. The starch, when converted into sugar, and the sugar, itself, are quite readily digested and absorbed into the circulation, but the fiber is much less easily digested, although fulfilling a similar function to the extent it is digested.

The largest part of vegetable foods contain this class of nutrients, which, however, are not stored up in the body as carbohydrates, but are either converted (changed) into fat, or used up; that is, oxidized, or burned up, to produce heat and energy.

A rice field after harvest.

(5) Fat or Ether Extract.

Fat is represented by the true vegetable fats and oils, like the oil in cotton seed or corn, as well as vegetable wax; and as these may be extracted from a water-free sample of food material by means of ether, the name, ether extract, is frequently given to this group.

Fats serve almost the same purpose in the animal economy as do the carbohydrates, only they contain a relatively larger amount of carbon, and give off more heat during their combustion, or burning up, in the body, on that account. For example, if vegetable fats, or plant oils, are burned, they give off 2.25 times as much heat as the carbohydrates (starch, sugar, etc.). So that, for the production of heat and energy in the body, one pound of fat is the equivalent of 2.25 pounds of carbohydrates.

As a general proposition it may be stated, that the foundation principles of nutrition are the same in the case of all animals, and that the function of food is (1) to supply material to build up and repair the tissues of the body; and (2) to yield energy. Hence, the intelligent use of food is directed to supply the waste of the materials occasioned by the act of living and the performance of work. And, according to the amount of work performed, and, consequently, the amount of material (tissues) used up or consumed within the body, the amount and ingredients of the food have to be regulated. And, as is well known, combustion, or the creation of heat, produces energy in some form, which takes place when the food is consumed or burned up within the animal body.

Harvesting alfalfa at the State Experiment Station.

Having become familiar with the names of the nutritive substances contained in plants and animals, and required by the latter for their sustenance, the next step is to know the average amounts of these the various plants, or food materials, contain.

This information has already been obtained, by the chemist, for the great majority of our stock foods; and again referring to oats as an example, are expressed as follows:

Percentage Composition of Oats.

Water.	Ash.	Protein.	Crude Fiber.	Carbohydrates.	Fat.
11.0	3.0	11.8	9.5	59.7	5.0

This means, that in 100 pounds of oats there are 11 pounds of water; 3 pounds ash; 11.8 pounds protein; 9.5 pounds crude fiber; 59.7 pounds carbohydrates; and 5 pounds of fat. Or, as previously stated, 89 pounds of dry matter, and 11 pounds of water.

The above table shows the percentage of the different nutrients contained in oats, which is very important, but further information is needed, concerning this food stuff, before we are able to realize its true value as a food. In other words, we require to know what percentage of the amounts of the substances mentioned can be digested by the animal. This information has also been furnished by the chemist (the physiological chemist); and again, with oats as an example, is expressed as follows:

Average Percentage Digestibility of Oats.

Dry Matter.	Protein.	Crude Fiber.	Carbohydrates.	Fat.
70	78	20	76	83

This means that 70 per cent. of the 89 pounds of dry matter in oats is digestible; 78 per cent. of the amount of the protein; 20 per cent. of the crude fiber; 76 per cent. of the carbohydrates; and 83 per cent. of the fat. Or, stated in another way: In the 89 pounds of dry matter contained in 100 pounds of oats there are the following amounts of the principal digestible nutrients:

Protein.	Carbohydrates.	Fat.
lbs.	lbs.	lbs.
9.2	47.3	4.2

It is not sufficient, therefore, to know the chemical composition of a food stuff only, although that is quite important as a guide, but we must also know what per cent. of the ingredients are digestible. Because, it is possible for two foods to contain exactly the same amount of chemical substances, and appear to be, theoretically, of the same value; while the difference in the digestibility of the substances may be such as to render one doubly as nutritious as the other, and, in consequence, of much greater value as a food.

There are two very important facts that should be indelibly impressed upon the feeder's mind, viz., (1) that a food stuff should be palatable; and (2) that it should be digestible, which means its power of becoming soluble and of undergoing absorption into the blood, for the purposes of nutrition.

A field of sorghum yielding three cuttings a year.

BALANCING THE RATION.

The feeder having acquired an intelligent conception of the different nutritive substances contained in plants, etc. (foodstuffs), and the part each plays in building up the various tissues of the animal body, and in producing power and energy; also the average amounts of these substances; and lastly, their percentage digestibility, the next step is to be able to supply them in such quantity and proportion as will best suit the needs of the animal, whether for maintenance, for work of different grades, for the production of flesh, fat, milk, wool, etc. This is known as "balancing the ration;" and the "ration" means the amount or allowance of food given to an animal during twenty-four hours.

For example, it has been ascertained, as the result of careful investigation, that a horse, or mule, weighing 1,000 pounds, and doing what is classed as heavy work, requires for its sustenance, and the performance of such work, a daily food-ration containing the digestible nutrients, as previously alluded to, in about the following proportions, and which is known as the Wolff-Lehmann standard for this class of animal:

Dry Matter. lbs.	Protein. lbs.	Carbohydrates. lbs.	Fat. lbs.	Nutritive Ratio.
26.	2.5	13.3	0.8	1:6

Although it is not essential to be mathematically exact, it is just as necessary to have a standard in feeding as in any other work, as a guide, in order to be able to come within reasonable approximation of it.

The following will serve to illustrate a balanced ration approximating the Wolff-Lehmann standard:

lbs.		Dry Matter. lbs.	Digestible Protein. lbs.	Digestible Carbohydrates. lbs.
6	Molasses	4.80	0.00	3.90
8	Corn and cob meal......	6.80	0.35	5.32
2	Cotton seed meal.......	1.84	0.74	0.89
15	Peavine hay	13.21	1.41	6.16
31		26.65	2.50	16.27

Nutritive ratio, 1:6.5

The fat in this ration does not appear, as it has been reduced to its equivalent in starch (carbohydrate) by multiplying the amount by 2.25 (previously explained) and added to the carbohydrate already present. (It should perhaps be stated here that the nitrogenous bodies in the cane molasses are not expressed under protein, in the above illustration, as they are in the form of amids, and there seems still to be some doubt as to their function as flesh-formers. The percentage in the mill molasses from sugar cane being only 1.40, we have discarded it in the computation, and have relied upon other materials to supply the required amount of protein in the ration).

A nitrogenous roughage—medium red clover.

NUTRITIVE RATIO.

A term of importance, used in feeding parlance, is the "nutritive or nutrient ratio." This means the ratio existing between the amount of the digestible protein and the total digestible carbohydrates (C. Hydrates plus the fat reduced), or, in other words, between the digestible nitrogenous and non-nitrogenous ingredients of the ration, and is obtained by dividing the amount of the total carbohydrates by the amount of the protein. For example, the total amount of carbohydrates in the illustration is 16.27 pounds. If this is divided by 2.5 pounds, the total amount of the protein, we [illegible] 6.5. Or, as it is expressed: 1:6.5 (one to six and five-tenth [illegible] the nutritive ratio of the ration.

Evidence of diversification.

WIDTH OF RATIONS.

A ration is said to be narrow or wide according as the relation existing between the digestible protein and the digestible (total) carbohydrates is close or wide. According to some authorities (Jordan, for instance), a narrow ratio is one where the proportion of protein is relatively large, not less perhaps than 1:5.5. A wide ratio is one where the carbohydrates are very greatly predominant, or in larger proportion perhaps than 1:8.0. Anything between 1:5.5 and 1:8.0 may properly be spoken of as a medium ratio. Frequently the term, "one-sided" is used in the case of either a narrow or a wide ration.

The following will serve to illustrate a narrow ration in which the ratio between the protein and the carbohydrates is close:

lbs.		Dry Matter. lbs.	Protein. lbs.	Total C. Hydrates. lbs.
3	Cotton seed meal........	2.76	1.12	1.33
11	Oats	9.79	1.01	6.25
15	Alfalfa hay	13.80	1.65	6.34
29		26.35	3.78	13.92

Nutritive ratio, 1:3.8

The nutritive ratio in this illustration, between the 3.78 pounds of dgestible protein and the 13.92 pounds of total digestible carbohydrates is as one to three and eight-tenths; or, expressed in figures, 1:3.8. For a similar reason, viz., that the relation between the protein and corbohydrates is close, a narrow ration is sometimes termed a nitrogenous ration.

Conversely, when the ratio between the digestible nutrients of a ration is wide, it is termed a wide ration, or, on account of the excessive relative amount of carbohydrates, a carbonaceous ration.

The following will illustrate a wide ration:

lbs.		Dry Matter. lbs.	Protein. lbs.	Total C. Hydrates. lbs.
10	Molasses	8.00	0.00	6.50
5	Corn	4.45	0.40	5.35
15	Timothy hay	13.05	0.42	6.98
30		25.50	0.82	18.83

Nutritive ratio, 1:23

In the above ration the ratio between the eighty-two one-hundredths (82-100s) of a pound of protein and the 18.83 pounds of carbohydrates, is as one to twenty-three, or, 1:23.

The width of rations differs according to the use that is to be made of them. Young growing animals, for example, require food that has a narrow nutritive ratio, which means plenty of protein, for growth and development, the best example of which is, perhaps, milk, with the narrow ratio of about 1:3.7 in the case of cow's milk. Hardworking adult animals require a medium-ratio-ration; while idle animals, or those in which maintenance of condition, only, is desired, can subsist on food of a more carbonaceous nature, or that with a fairly wide nutritive ratio.

Again, in the case of cattle that are being fattened, the width of the nutritive ratio is changed, somewhat, during the different periods of the process in order to obtain the best and most economic results.

A field of alfalfa.

Successful stock-feeding is not dependent altogether upon the use of any one particular variety of raw material. It is true that oats is generally conceded to be the food, par excellence, for the horse or mule; because the digestible nutrients happen to be about typically balanced in this cereal. But oats may be looked upon as an expensive foodstuff with us, when they have to be purchased, and, if we can, by mixing together other cheaper, palatable and digestible materials, obtain the same amount of nutritive substances, and in the same nutritive ratio, as exist in oats, we are getting what we want from a cheaper source, besides allowing variety, and, in consequence, practicing economy, but at the same time, allowing the animal the same quantity of digestible nutrients as is contained in oats. And so it is with other varieties of food stuffs.

The following illustration will serve to elucidate this point:

	Dry Matter.	Protein.	Total C. Hydrates.	
lbs.	lbs.	lbs.	lbs.	
15 Oats.......	13.35	1.38	8.52	@ 40c. per bu., 19c.
15 Mixed Grass and Clover Hay.	13.05	0.93	6.90	@ $15 per ton, 11c.
30	26.40	2.31	15.42	30c.

Nutritive ratio, 1:6.6.

	Dry Matter.	Protein,	Total C. Hydrates.	
lbs.	lbs.	lbs.	lbs.	
6 Molasses.......	4.80	0.00	3.90	@ 5c. per gal., 2 1-2c.
8 Corn & Cob Meal	6.80	0.35	5.32	@ 56c. per bu. 8c.
2 Cot. Seed Meal.	1.84	0.74	0.89	@ $25 per ton, 2 1-2c.
15 Peavine Hay ...	13.21	1.41	6.16	@ $15 per ton, 11 1-4c.
31	26.65	2.50	16,27	24 1-4c.

Nutritive ratio, 1;6.5.

At the prices quoted, the ration composed of the mixed materials furnishes practically the same amount of dry matter and digestible nutrients as is contained in the oat and hay ration, and at a saving of 5 3-4 cents. This may appear a somewhat insignificant item, in the case of a single animal, and per day, but where large numbers have to be fed, as is the case with the mules on our large sugar estates, it represents the saving of a considerable amount of money in the course of the year.

Incidentally, and in this connection, a comparison might be here shown with commercially mixed feeds costing, say, $24.00 per ton.

These feeds represent the concentrated part of the ration, that is, without the roughage or hay. In the illustration just given, the concentrates represent 16 pounds, and at the prices quoted, cost 13 cents. While, 16 pounds of a commercially mixed feed, at the rate of $24.00 per ton, cost 19 1-5 cents, or a difference, in this particular case, of 6 1-5 cents per animal per day.

Besides, when the materials are raised at home, the actual cost would of course be considerably less to the feeder. Furthermore, he would know exactly the kind, condition and percentage digestibility of the materials composing his ration. Our object here is not to underestimate the commercial article, but to show to our own people, those whom it is our province to serve, some of the advantages of being able to utilize their own products and by-products as food for their animals.

A field of cow peas.

A point worthy of the feeder's attention, is: That it is not the bulk of the food, or in the form in which it is most familiar to us, that goes to nourish the animal body, but the soluble, digestible nutrients contained in it. In fact the more rational way to base an estimate on the real value of a feeding material is by the amount it contains of these nutrients in digestible form, rather than merely on account of its happening to be oats, corn, hay, etc. It is quite probable, we think, that the time may come when the feeder, instead of talking of purchasing the raw material, as oats, corn, molasses, cotton seed meal, etc., will speak of buying protein, carbohydrates, and fat, which are, in reality, the only nutritious parts of the food; the great bulk of material most familiar to us, passing out from the body as residue or inert matter, after having given up its soluble nutritive substances to the blood. And, although a certain amount of bulk in food seems to play an important part in assisting the digestive processes, it is only those nutrients that can enter the blood stream and be carried all over to nourish the various tissues of the body.

Peavine hay in cocks.

FEEDING STANDARDS OR GUIDES TO THE FEEDER.

The quantity of each of the digestible food nutrients (protein, carbohydrates and fat) required, per 1,000 pounds live weight of animal per day, for a given purpose, and contained in the ingredients composing the ration, is expressed in the term, "Feeding Standard."

As previously mentioned, these standards are only intended to guide the feeder in compounding or preparing mixtures of food materials, so that he may be able to make up a ration capable of furnishing, approximately, the amounts and proportions of the digestible nutrients desired in feeding for a specific purpose.

The Feeding Standards given in the following table (No. 1) are chiefly based upon the results of German investigators, the arrangement being that of Armsby, in Circular of Information No. 1, issued by the Pennsylvania State College, and in some respects differ slightly from the Wolff-Lehmann standard.

We quote the following from Prof. W. A. Henry's valuable work on "Feeds and Feeding:"

"Standards are arranged to meet the requirements of farm animals under normal conditions. The student (or feeder) should not accept the statements in the standards as absolute, but rather as data of a helpful nature to be varied in practice as circumstances suggest. The statements in the column headed 'Dry Matter' should be regarded as approximate only, since the digestive tract of the animal readily adapts itself to variations of 10 per cent. or more, from the standard of volume.

"The standards are for animals of normal size. Those of smaller breeds will require more nutrients, amounting in some cases to 0.3 of a pound of nitrogenous, and 1.5 pounds of non-nitrogenous digestible nutrients daily for 1,000 pounds of live weight of animals.

"Narrowing the nutritive ratio in feeding full-grown animals is for the purpose of lessening the depression of digestibility, to enliven the temperament, or to increase the production of milk at the expense of laying on of fat.

"The different standards given for the same class of animals, according to performance, illustrate the manner and direction in which desirable changes should be made.

"In considering the fattening standards the student should bear in mind that the most rapid fattening is usually the most economical, so that the standards given may often be profitably increased.

"Standards for milch cows are given for the middle of the lactation period with animals yielding milk of average composition.

"The standards for growing animals contemplate only a moderate amount of exercise; if much is taken, add 15 per cent.—mostly non-nitrogenous nutrients—to the ration. If no exercise is taken, deduct 15 per cent. from the standard."

TABLE I—FEEDING STANDARDS.

A—Per day and 1.000 pounds live weight.*

		Dry matter	Digestible			Nutritive ratio
			Protein	Carbohydrates and fat	Total	
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	
Oxen at rest in stall		17.5	0.7	8.3	9.0	1:11.9
Wool sheep, coarser breeds		20.0	1.2	10.8	12.0	1:9.0
Wool sheep, finer breeds		22.5	1.5	12.0	13.5	1:8.0
Oxen moderately worked		24.0	1.6	12.0	13.0	1:7.5
Oxen heavily worked		26.0	2.4	14.3	16.7	1:6.0
Horses lightly worked		20.0	1.5	10.4	11.9	1;6.9
Horses moderately worked		21.0	1.7	11.8	13.5	1:6.9
Horses heavily worked		23.0	2.3	14.3	16.6	1:6.2
Milk cows, Wolff's standard		24.0	2.5	13.4	15.9	1:5.4
Milk cows, Wisconsin standard		24.5	2.2	14.9	17.1	1:6.8
Fattening oxen, preliminary period		27.0	2.5	16.1	18.6	1:6.4
Fattening oxen, main period		26.0	3.0	16.4	19.4	1:5.5
Fattening oxen, finishing period		25.0	2.7	16.2	18.9	1:6.0
Fattening sheep, preliminary period		26.0	3.0	16.3	19.3	1:5.4
Fattening sheep, main period		25.0	3.5	15.8	19.3	1:4.5
Fattening swine, preliminary period		36.0	5.0	27.5	32.5	1:5.5
Fattening swine. main period		31.0	4.0	24.0	28.0	1:6.0
Fattening swine, finishing period		23.5	2.7	17.5	20.2	1:6.5
Growing cattle:	*Average live weight*					
Age. Months	*per head.*					
2- 3	150 lbs	22.0	4.0	18.3	22.3	1:4.6
3- 6	300 lbs	23.4	3.2	15.8	19.0	1:4.9
6-12	500 lbs	24.0	2.5	14.9	17.4	1:6.0
12-18	700 lbs	24.0	2.0	13.9	15.9	1:7.0
18-24	850 lbs	24.0	1.6	12.7	14.3	1:8.0
Growing sheep:						
5- 6	56 lbs	28.0	3.2	17.4	20.6	1:5.4
6- 8	67 lbs	25.0	2.7	14.7	17.4	1:5.4
8-11	75 lbs	23.0	2.1	12.5	14.6	1:6.0
11-15	82 lbs	22.5	1.7	11.8	13.5	1:7.0
15-20	85 lbs	22.0	1.4	11.1	12.5	1:8.0
Growing fat pigs.						
2- 3	50 lbs	42.0	7.5	30.0	37.5	1:4.0
3- 5	100 lbs	34.0	5.0	25.0	30.0	1:5.0
5- 6	125 lbs	31.5	4.3	23.7	28.0	1;5.5
6- 8	170 lbs	27.0	3.4	20.4	23.8	1:6.0
8-12	250 lbs	21.0	2.5	16.2	18.7	1:6.5

B—Per day and per head

		Dry matter	Protein	Carbohydrates and fat	Total	Nutritive ratio
Growing cattle:						
2- 3	150 lbs	3.3	0.6	2.8	3.4	1:4.6
3- 6	300 lbs	7.0	1.0	4.9	5.9	1:4.9
6-12	500 lbs	12.0	1.3	7.5	8.8	1:6.0
12-18	700 lbs	16.8	1.4	9.7	11.1	1;7.0
18-24	850 lbs	20.4	1.4	11.1	12.5	1;8.0
Growing sheep:						
5- 6	56 lbs	1.6	0.18	0.974	1.154	1:5.4
6- 8	67 lbs	1.7	0.18	0.981	1.161	1;5.4
8-11	75 lbs	1.7	0.16	0.953	1.113	1:6.0
11-15	82 lbs	1.8	0.14	0.975	1.115	1:7.0
15-20	85 lbs	1.9	0.12	0.955	1.075	1:8.0
Growing fat swine:						
2- 3	50 lbs	2.1	0.38	1.50	1.88	1:4.0
3- 5	100 lbs	3.4	0.50	2.50	3.00	1:5.0
5- 6	125 lbs	3.9	0.54	2.96	3.50	1;5.5
6- 8	170 lbs	4.6	0.58	3.47	4.05	1;6.0
8-12	250 lbs	5.2	0.62	4.05	4.67	1:6.5

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*The fattening rations are calculated for 1,000 lbs. live weight at the beginning of the fattening.

In table No. 2, is given the average percentage composition, and per cent. of digestible matter, of a number of American feeding stuffs, more or less of which are available in Louisiana, the data having been obtained from various sources, notably, Henry's "Feeds and Feeding," Jordan's "Feeding of Farm Animals," and Bulletin No. 163 of the North Carolina Experiment Station, besides that secured from results by our own Stations.

It might be stated here, in this connection, that Louisiana has some food materials which have not, as yet, been worked up. It is the intention of the Station, however, to pursue work along this line, as early as time and facilities will permit, in order to get the average percentage chemical composition, and to conduct digestion experiments to obtain the per cent. of digestible matter, in those food stuffs. The results will be published in a separate bulletin just as soon as the information has been secured.

In explanation of the use of Table No. 2, it should be stated that the first division of it is devoted to the average percentage chemical composition of each individual food-stuff; while the division under, "Per Cent. of Digestible Matter," gives the amount that is digestible of the principal nutrients. For example, if we again turn to oats, we find that it contains, in 100 pounds, 11.8 pounds of protein, 78 per cent. of which is digestible; or, a little over 9 pounds of digestible protein in 100 pounds of oats, as shown in the second division.

A table is generally given in works on feeding to show the coefficient of digestibility of the different nutrients in feeds. We have done away with the necessity for this, however, and, consequently, avoided an extra table, by giving the results in the second division. To illustrate: The factor, 78, in the above example, represents the coefficient of digestibility of the crude protein in oats. The 9 pounds is the result obtained by multiplying the amount of crude protein by 78, the per cent. which its average digestibility represents.

The second division, therefore, obviates the necessity of the feeder having to make the reduction, in the case of each feed, when balancing a ration.

The food stuffs which do not show their per cent. of digestible matter, in the second division of the table, are those about which we could not obtain the necessary data. In practice, however, it may be possible to average them with others of the same class and having a similar chemical composition.

With reference to low-grade sugar cane molasses (blackstrap), it should be stated, in order to avoid confusion, that the data with reference to protein, given in the table, differs slightly from that given in one of our previous illustrations. The figures given in the table are from a number of analyses, made subsequently, by Mr. J. E. Halligan, chemist of the Station.

Halligan's figures show a slightly larger protein content. However, as mentioned in a former part of the bulletin, the nitrogenous bodies (under protein) in molasses, are amids, with a still doubtful value as to their flesh-forming function. So that, in compounding a ration, with blackstrap as an ingredient, the "protein" of the latter is discarded, and the required amount of this nutrient obtained from some other source.

TABLE No. II.

AVERAGE COMPOSITION OF FEEDING STUFFS.

FEED	PERCENTAGE COMPOSITION							PER CENT. OF DIGESTIBLE MATTER				
	Dry Matter	Water	Ash	Protein	Carbohydrates (Nitrogen—Free extract)	Crude Fibre	Fat (Ether extract)	Protein	Carbohydrates	Crude Fibre	Fat	
Oats (Grain)	89.0	11.0	3.0	11.8	59.7	9.5	5.0	9.3	44.8	2.8	3.5	
Corn (Grain)	89.4	10.6	1.5	10.3	70.4	2.2	5.0	7.8	65.5	1.3	4.3	
Corn Meal	85.0	15.0	1.4	9.2	68.7	1.9	3.8	5.5	63.9	0.6	3.5	
Corn and Cob Meal	84.9	15.1	1.5	8.5	64.8	6.6	3.5	4.4	57.0	3.0	2.9	
Hominy Chops	88.9	11.1	2.5	9.8	64.5	3.8	8.3	7.5	55.0	....	6.8	
Wheat (Grain)	89.5	10.5	1.8	11.9	71.9	1.8	2.1	10.2	69.0	....	1.7	
Wheat Bran	88.1	11.9	5.8	15.4	53.9	9.0	4.0	12.1	37.2	2.0	2.7	
Wheat Middlings	87.9	12.1	3.3	15.6	60.4	4.6	4.0	12.8	51.3	1.7	3.4	
Rye (Grain)	88.4	11.6	1.9	10.6	72.5	1.7	1.7	9.9	67.6	....	1.1	
Cotton Seed	89.7	10.3	3.5	18.4	24.7	23.2	19.9	12.5	12.3	17.6	17.3	
Cotton Seed, Roasted	93.9	6.1	5.5	16.8	23.5	20.4	27.7	....	....	....	....	
Cotton Seed Meal	91.8	8.2	7.2	42.3	23.6	5.6	13.1	37.2	15.1	1.8	12.2	
Rice (Rough)	89.1	10.9	5.5	7.4	64.3	9.3	2.6	....	....	....	....	
Rice (Clean)	87.2	12.8	0.7	7.5	78.1	0.5	0.4	....	....	....	....	
Rice Bran, 15 per cent. hulls	90.1	9.9	11.3	9.9	44.5	14.5	9.9	6.4	34.8	1.9	5.4	La. Sta.
Rice Polish	88.5	11.5	3.5	11.1	64.3	3.8	5.8	7.3	59.6	0.8	4.3	
Rice Meal (Pure Bran)	91.4	8.6	8.9	13.3	49.8	8.7	10.7	8.6	38.9	1.1	5.9	
Buckwheat	87.4	12.6	2.7	10.0	64.5	8.7	2.2	7.7	49.0	....	1.8	
Cane Molasses (Blackstrap)	77.6	22.4	9.3	2.4	65.9	....	....	....	65.9	....	....	Halligan, La. Sta.
Beet Molasses	79.2	20.8	10.6	9.1	59.5	....	....	....	59.5	....	....	
Skimmed Milk (Separator)	9.4	90.6	0.7	3.1	5.3	....	0.3	2.9	5.2	....	0.3	

Skimmed Milk (Gravity)	9.6	90.4	0.7	3.3	4.7	....	0.9	3.1	4.7	....	0.8	
Buttermilk	9.9	90.1	0.7	4.0	4.0	....	1.1	3.9	4.0	....	1.1	
Oat Hay (cut in milk)	85.0	15.0	5.2	9.3	39.0	29.2	2.3	5.0	20.3	12.7	1.4	
Oat Straw	90.8	9.2	5.1	4.0	42.4	37.0	2.3	1.2	18.7	20.0	0.8	
Corn Fodder (leaves)	91.1	8.9	9.7	11.8	41.5	24.7	3.3	5.3	26.3	17.1	2.0	
Corn Fodder (whole plant)	67.8	32.2	4,3	4.8	37.2	20.2	1.3	2.6	23.6	13.8	0.9	
Corn Stover (whole plant, except ears)	77.2	22.8	4.9	5.5	39.9	25.6	1.3	2.8	25.3	17.0	0.7	
Corn Shucks	91.9	8.1	3.4	3.3	51.6	32.8	0.9	1.0	38.6	26.1	0.3	
Wheat Straw	90.4	9.6	4.2	3.4	43.4	38.1	1.3	0.4	16.5	19.8	0.4	
Rye Straw	92.9	7.1	3.2	3.0	46.6	38.9	1.2	0.6	17.2	23.3	0.4	
Rice Straw	88.0	12.0	7.8	5.9	33.7	38.6	2.1	2.7	10.8	22.0	1.0	
Buckwheat Straw	90.1	9.9	5.5	5.2	35.1	43.0	1.3	....	....	....	....	
Cotton Seed Hulls	88.9	11.1	2.8	4.2	33.4	46.3	2.2	0.25	11.4	21.8	1.7	
Cow Pea Hay	88.1	11.9	8.4	14.4	41.2	21.5	2.5	9.30	29.1	9.2	1.2	
Alfalfa Hay	91.6	8.4	7.4	14.3	42.7	25.0	2.2	10.60	28.2	10.7	0.9	
Soja Bean Hay	88.7	11.3	7.2	15.4	38.6	22.3	5.2	10.90	26.6	13.6	1.5	
Vetch Hay	88.7	11.3	7.9	17.0	36.1	25.4	2.3	12.90	23.8	13.7	1.4	
Peanut Vine Hay (without nuts)	92.4	7.6	10.8	10.7	42.7	23.6	4.6	6.70	29.9	12.3	3.0	
Crimson Clover Hay	90.4	9.6	8.6	15.2	36.6	27.2	2.8	10.50	22.7	12.2	1.2	
Red Clover Hay	84.7	15.3	6.2	12.3	38.1	24.8	3.3	7.60	26.3	12.1	2.0	
Lespedeza Hay (Pure)	88.5	11.5	4.1	9.6	40.1	31.4	3,3	....	....	....	....	Halligan & Hall La. Sta.
Lespedeza (mixed with grass)	88.3	11.7	5.3	7.0	41.1	31.8	3.1	....	....	....	....	
Crab Grass Hay	89.7	10.3	7.3	6.9	41.0	32.9	1.6	2.2	21.6	21.2	0.6	
Orchard Grass Hay	90.1	9.9	6.0	8.1	41.0	32.4	2.6	4.9	22.5	19.8	1.4	
Timothy Hay	86.8	13.2	4.4	5.9	45.0	29.0	2.5	2.8	28.3	15.1	1.4	La. Bull. 34.
Bermuda Grass Hay	92.8	7.1	3.5	10.7	51.0	25.0	2.9	....	....	....	....	
Kentucky Blue Grass Hay	78.8	21.2	6.3	7.8	37.8	23.0	3.9	....	....	....	....	
Millet Hay (Cat Tail)	89.5	10.5	10.2	9.9	36.6	30.8	2.0	6.2	21.6	20.5	0.9	
Johnson Grass Hay	88-8	10.2	6.1	7.2	45.9	28.5	2.1	3.2	24.8	16.5	0.8	
Corn Silage	20.9	79.1	1.4	1.7	11.0	6.0	0.8	0.9	7.6	3.7	0.7	
Sorghum Silage	23.9	76.1	1.1	0.8	15.3	6.4	0.3	0.6	15.0	....	0.2	
Soja Bean Silage	25.8	74.2	2.8	4.1	6.9	9.7	2.2	2.7	3.9	4.7	1.3	
Cow Pea Silage	20.7	79.3	2.9	2.7	7.6	6.0	1.5	1.5	5.5	3.1	0.9	
Sorghum (Green)	20.6	79.4	1.1	1.3	11.6	6.1	0.5	0.6	8.6	3.6	0.4	

TABLE No. II—Continued.

FEED	PERCENTAGE COMPOSITION							PER CENT. OF DIGESTIBLE MATTER			
	Dry Matter	Water	Ash	Protein	Carbohydrates (Nitrogen—free extract)	Crude Fibre	Fat (Ether extract)	Protein	Carbohydrates	Crude Fibre	Fat
Corn (Green)	20.7	79.3	1.2	1.8	12.2	5.0	0.5	0.9	9.0	3.0	0.3
Alfalfa (Green)	28.2	71.8	2.7	4.8	12.3	7.4	1.0	3.9	9.3	3.3	0.5
Cow Pea (Green)	16.4	83.6	1.7	2.4	7.1	4.8	0.4	1.8	6.0	2.7	0.2
Lespedeza (Green)	30.0			2.7	14.4		0.6				
Oats (in bloom)	37.8	62.2	2.5	3.4	19.3	11.2	1.4	2.5	12.1	6.7	1.0
Rye (Green)	23.4	76.6	1.8	2.6	6.8	11.6	0.6	2.0	4.8	9.3	0.4
Cabbage	9.5	90.5	1.4	2.3	3.9	1.5	0.4	1.8	*8.2		0.4
Ruta Bagas	11.4	88.6	1.2	1.2	7.5	1.3	0.2	1.0	7.1	1.0	0.2
Carrots	11.4	88.6	1.0	1.1	7.6	1.3	0.4	0.8	*7.8		0.2
Mangel Wurtzel	9.1	90.9	1.1	1.4	5.5	0.9	0.2	1.1	5.0	0.4	0.1
Rape	15.5	84.5	2.0	2.2	8.3	2.5	0.5	1.5			0.2
Potatoes (Irish)	21.1	78.9	1.0	2.1	17.3	0.6	0.1	0.9	*16.3		0.1
Potatoes (Sweet)	28.9	71.1	1.0	1.5	24.7	1.3	0.4	0.9	*22.2		0.3
Brewers' Grains (wet)	24.3	75.7	1.0	5.4	12.5	3.8	1.6	3.9	7.7	1.5	1.4
Brewers' Grains (dried)	91.8	8.2	3.6	19.9	51.7	11.0	5.6	15.7	30.0	6.0	5.1

*Combined Carbohydrates and Fibre.

Table No. III is given as a convenient "ready reckoner" to enable the feeder to compound rations with as little trouble as possible.

It has been arranged to show the amount of "total dry matter" and "digestible nutrients" in 1, 2, 3, 4, 5, and 10 pounds of a number of available feeding stuffs, based upon their average composition and percentage digestibility.

For example: If the feeder desires to use 10 pounds shelled corn and 12 pounds alfalfa hay for a day's ration, by consulting the table he will find that these two feeds contain the following amount of dry matter and digestible nutrients:

		Dry Matter.	Protein.	C. Hydrates.	Fat.
lbs.		lbs.	lbs.	lbs.	lbs.
10	Corn	8.94	0.78	6.68	0.43
12	Alfalfa hay	10.99	1.27	4.66	0.10
		19.93	2.05	11.34	0.53

In an earlier part of this bulletin it was mentioned that the fat in a food stuff was equivalent to 2 1-4 (2.25) times its amount in carbohydrates, because when burned up it gave 2 1-4 times as much heat. Consequently, we have to multiply the 0.53 pounds of fat, in the above, by 2 1-4 to reduce it to its carbohydrate equivalent, and then add it to the carbohydrates already present, thus:

0.53 pounds multiplied by 2.25 equals 1.19 pounds. This added to 11.34 pounds (the amount of carbohydrates present in the ration) gives 11.34 plus 1.19 equals 12.53 pounds of total carbohydrates. *It should be remembered then, that the amounts given in the "Fat" column have always to be reduced as above explained to get the amount of total carbohydrates, but, which need only be done after adding up the amount in the ration as a whole, and as has been done in the above illustration.*

If we desire to know the nutritive ratio of the above ration, we simply divide the amount of total carbohydrates by the amount of digestible protein, thus: 12.53 divided by 2.05 equals 6.1, which is the ratio between the protein and carbohydrates, and taking the former as the unit, 1, is expressed as 1:6.1 (one to six and one-tenth).

In compounding rations, it is usually necessary to make trials, with the standard as a guide, and often takes several of these before approximating the standard requirements. Presuming that we wanted to compound a ration for a mule, or horse, weighing 1,000 pounds, and at hard work, we would first consult Table No. 1 to get the standard, which we would find to be:

Dry Matter. lbs.	Protein. lbs.	Total Carbohydrates. lbs.	Nutritive Ratio.
2~~5~~3.0	2.3	14.3	1:6.2

If corn, corn fodder and peavine hay should be our available feeding materials, we could, by consulting Table No. 3, make the following trial:

lbs.		Dry Matter. lbs.	Protein. lbs.	C. Hydrates. lbs.	Fat. lbs.
10	Corn	8.94	0.78	6.68	0.43
5	Peavine hay	4.41	0.47	1.92	0.06
10	Corn fodder	9.11	0.53	4.33	0.20
		22.46	1.78	12.93	0.69

Or, after the fat was reduced, would be:

	Dry Matter. lbs.	Protein. lbs.	Total C. Hydrates. lbs.	Nut. Ratio.
	22.46	1.78	14.48	1:8.2
Standard.	2~~5~~3.0	2.3	14.3	1:6.2

Although the total carbohydrates are close enough, this trial ration is deficient in protein, and a little below in dry matter (which is not a serious deficiency so long as the required amount of the nutrients is present), with the ratio too wide.

The cheapest available source of protein we have is cotton seed meal. By consulting Table No. 3, we find that one and one-half pounds of this feed contain 1.38 pounds dry matter; 0.56 pounds protein, and 0.65 pounds total carbohydrates, which, when added to the above trial ration, gives the following:

	Dry Matter. lbs.	Protein. lbs.	Total C. Hydrates. lbs.	Nut. Ratio.
	22.46	1.78	14.48	
	1 38	0.56	0.65	
	23.84	2.34	15.13	1:6.4
Standard.	25.00 3	2.30	14.30	1:6.2

By the addition of one and one-half pounds of cotton seed meal to the 10 pounds corn, 5 pounds peavine hay, and 10 pounds corn fodder, therefore, although the carbohydrates are slightly in excess, we have compounded a ration which comes reasonably close to the standard requirements of a 1,000 pound mule, or horse, doing hard work.

When it is desired to know the digestibie nutrients in any amount not given in the table, the result may be obtained by adding or multiplying, as the case may be, some of those mentioned. For instance: If the nutrients in 7 pounds of a food stuff are wanted, add the amounts under 4 and 3, or 5 and 2, together; if 15 pounds, multiply the amounts given for 5 pounds by three times, or, add 10 and 5 together, etc.

It will be noticed that in Table No. 2 "crude fibre" is mentioned, but does not appear in Table No. 3. In the latter the digestible crude fibre has been combined with the digestible carbohydrates, the digestible portions of each being considered of about equal value in the process of nutrition.

A considerable part of the data in Table No. 3 has been arranged from that given in The Bulletin of the North Carolina Department of Agriculture on "Feeding Farm Animals," by Butler and Kilgore.

TABLE III—SHOWING AMOUNT OF DRY MATTER AND DIGESTIBLE MATERIALS IN 1, 2, 3. 4, 5 AND 10 LBS. OF FEED STUFFS.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbo-hydrates—Pounds	Fats—Pounds
Oats (horses)	1	.890	.093	.475	.036
	2	1.780	.186	.950	.072
	3	2.670	.279	1.425	.108
	4	3.560	.372	1.900	.144
	5	4.450	.465	2.375	.180
	10	8.900	.930	4.750	.360
Corn (whole—12 experiments with ruminants.)	1	.894	.078	.668	.043
	2	1.788	.156	1.336	.086
	3	2.682	.234	2.004	.129
	4	3.576	.312	2.672	.172
	5	4.470	.390	3.340	.215
	10	8.940	.780	6.680	.430
Corn meal (5 experiments with ruminants.)	1	.850	.055	.639	.035
	2	1.700	.110	1.278	.070
	3	2.550	.165	1.917	.105
	4	3.400	.220	2.556	.140
	5	4.250	.275	3.195	.175
	10	8.500	.550	6.390	.350
Corn and cob meal (ruminants.)	1	.849	.044	.600	.029
	2	1.698	.088	1.200	.058
	3	2.547	.132	1.800	.087
	4	3.396	.176	2.400	.116
	5	4.245	.220	3.000	.145
	10	8.490	.440	6.000	.290
Hominy chops	1	.889	.075	.552	.068
	2	1.778	.150	1.104	.136
	3	2.667	.225	1.656	.204
	4	3.556	.300	2.208	.272
	5	4.445	.375	2.760	.340
	10	8.890	.750	5.520	.680
Wheat	1	.895	.102	.692	.017
	2	1.790	.204	1.384	.034
	3	2.685	.306	2.076	.051
	4	3.580	.408	2.768	.068
	5	4.475	.510	3.460	.085
	10	8.950	1.020	6.920	.170
Wheat bran	1	.881	.121	.392	.027
	2	1.762	.242	.784	.054
	3	2.643	.363	1.176	.081
	4	3.524	.484	1.568	.108
	5	4.405	.605	1.960	.135
	10	8.810	1.210	3.920	.270

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbohydrates—Pounds	Fats—Pounds
Wheat middlings	1	.879	.128	.530	.034
	2	1.758	.256	1.060	.068
	3	2.637	.384	1.590	.102
	4	3.516	.512	2.120	.136
	5	4.395	.640	2.650	.170
	10	8.790	1.280	5.300	.340
Rye	1	.884	.099	.676	.011
	2	1.768	.198	1.352	.022
	3	2.652	.297	2.028	.033
	4	3.536	.396	2.704	.044
	5	4.420	.495	3.380	.055
	10	8.840	.990	6.760	.110
Cotton seed (raw)	1	.897	.125	.300	.173
	2	1.794	.250	.600	.346
	3	2.691	.375	.900	.519
	4	3.588	.500	1.200	.692
	5	4.485	.625	1.500	.865
	10	8.970	1.250	3.000	1.730
Cotton seed (roasted)	1	.94	....	....	....
	2	1.88	....	....	....
	3	2.82	....	....	....
	4	3.76	....	....	....
	5	4.70	....	....	....
	10	9.40	....	....	....
Cotton seed meal (ruminants.)	1	.918	.372	.169	.122
	2	1.836	.744	.338	.244
	3	2.754	1.116	.507	.366
	4	3.672	1.488	.676	.488
	5	4.590	1.860	.845	.610
	10	9.180	3.720	1.690	1.220
Buckwheat	1	.874	.077	.492	.018
	2	1.748	.154	.984	.036
	3	2.622	.231	1.476	.054
	4	3.496	.308	1.968	.072
	5	4.370	.385	2.460	.090
	10	8.740	.770	4.920	.180
Skimmed milk (separator.)	1	.094	.029	.052	.003
	2	.188	.058	.104	.006
	3	.282	.087	.156	.009
	4	.376	.116	.208	.012
	5	.470	.145	.260	.015
	10	.940	.290	.520	.030

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbo-hydrates—Pounds	Fats—Pounds
Skimmed milk (gravity)	1	.096	.031	.047	.008
	2	.192	.062	.094	.016
	3	.288	.093	.141	.024
	4	.384	.124	.188	.032
	5	.480	.155	.235	.040
	10	.960	.310	.470	.080
Buttermilk........	1	.099	.039	.040	.011
	2	.198	.078	.080	.022
	3	.297	.117	.120	.033
	4	.386	.156	.160	.044
	5	.485	.195	.200	.055
	10	.990	.390	.400	.110
Oat hay (cut in milk stage.)	1	.850	.050	.330	.014
	2	1.700	.100	.660	.028
	3	2.550	.150	.990	.042
	4	3.400	.200	1.320	.056
	5	4.250	.250	1.650	.070
	10	8.500	.500	3.300	.140
Oat straw........................	1	.908	.012	.386	.008
	2	1.816	.024	.772	.016
	3	2.724	.036	1.158	.024
	4	3.632	.048	1.544	.032
	5	4.540	.060	1.930	.040
	10	9.080	.120	3.860	.080
Corn fodder (leaves).......	1	.911	.053	.433	.020
	2	1.822	.106	.866	.040
	3	2.733	.159	1.299	.060
	4	3·644	.212	1.732	.080
	5	4.555	.265	2.165	.100
	10	9.110	.530	4.330	.200
Corn fodder (whole plant.)	1	6.78	.026	.375	.009
	2	1.356	.052	.750	.018
	3	2.034	.078	1.125	.027
	4	2.712	.104	1.500	.036
	5	3.390	.130	1.875	.045
	10	6.780	.260	3.750	.090
Corn stover (whole plant except in ears.)	1	.772	.028	.423	.007
	2	1.544	.056	.846	.014
	3	2.316	.084	1.269	.021
	4	3.088	.112	1.692	.028
	5	3.860	.140	2.115	.035
	10	7.720	.280	4.230	.070

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbohydrates—Pounds	Fats—Pounds
Corn husks (shucks)........	1	.919	.010	.647	.003
	2	1.838	.020	1.294	.006
	3	2.757	.030	1.941	.009
	4	3,676	.040	2.588	.012
	5	4.595	.050	3.235	.015
	10	9.190	.100	6.470	.030
Wheat straw........................	1	.904	.004	.363	.004
	2	1.808	.008	.726	.008
	3	2.712	.012	1.089	.012
	4	3.616	.016	1.452	.016
	5	4.520	.020	1.815	.020
	10	9.040	.040	3,630	.040
Rye straw............................	1	.929	.006	.406	.004
	2	1,858	.012	.812	.008
	3	2.787	.018	1.218	.012
	4	3.716	.024	1.624	.016
	5	4.645	.030	2.030	.020
	10	9.290	.060	4.060	.040
Cotton seed hulls..............	1	.889	.003	.331	.017
	2	1.778	.006	.662	.034
	3	2.667	.009	.993	.051
	4	3.556	.012	1.324	.068
	5	4.445	,015	1.655	.085
	10	8.890	.030	3.310	.170
Cowpea vine hay..	1	.881	.093	.384	.012
	2	1.762	,186	.768	.024
	3	2.643	.279	1.152	.036
	4	3.524	.372	1.536	.048
	5	4.405	.465	1.920	.060
	10	8,810	.930	3.840	.120
Alfalfa hay.........................	1	.916	.106	.389	.009
	2	1.832	.212	.778	.018
	3	2.748	.318	1.167	.027
	4	3.664	.424	1.556	.036
	5	4.580	.530	1.945	.045
	10	9.160	1.060	3.890	.090
Soja bean hay............	1	.887	.109	.402	.015
	2	1.774	.218	.804	.030
	3	2.661	.327	1.206	.045
	4	3.548	.436	1.608	.060
	5	4.435	.545	2.010	.075
	10	8.870	1.090	4.020	.150

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbo-hydrates—Pounds	Fats—Pounds
Vetch hay	1	.887	.129	.376	.014
	2	1.774	.258	.752	.028
	3	2.661	.387	1.128	.042
	4	3.548	.516	1.504	.056
	5	4.435	.645	1.880	.070
	10	8.870	1.290	3.760	.140
Peanut-vine hay (without nuts.)	1	.924	.067	.422	.030
	2	1.848	.134	.844	.060
	3	2.772	.201	1.266	.090
	4	3.696	.268	1.688	.120
	5	4.620	.335	2.110	.150
	10	9.240	.670	4.220	.300
Crimson clover hay	1	.904	.105	.349	.012
	2	1.808	.210	.698	.024
	3	2.712	.315	1.047	.036
	4	3.616	.420	1.396	.048
	5	4.520	.525	1.745	.060
	10	9.040	1.050	3.490	.120
Red clover hay	1	.847	.076	.384	.021
	2	1.694	.152	.768	.042
	3	2.541	.228	1.152	.063
	4	3.388	.304	1.536	.084
	5	4.235	.380	1.920	.105
	10	8.470	.760	3.840	.210
Lespedeza hay (pure)	1	.89	....	....	....
	2	1.78	....	....	....
	3	2.67	....	....	....
	4	3.56	....	....	....
	5	4.45	....	....	....
	10	8.90	....	....	....
Lespedeza hay (mixed with grass.)	1	.88	....	....	....
	2	1.76	....	....	....
	3	2.64	....	....	....
	4	3.52	....	....	....
	5	4.40	....	....	....
	10	8.80	....	....	....
Orchard grass hay	1	.901	.049	.423	.014
	2	1.802	.098	.846	.028
	3	2.703	.147	1.269	.042
	4	3.604	.196	1.692	.056
	5	4.505	.245	2.115	.070
	10	9.010	.490	4.230	.140

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbohydrates—Pounds	Fats—Pounds
Timothy hay	1	.868	.028	.434	.014
	2	1.736	.056	.868	.028
	3	2.604	.084	1.302	.042
	4	3.472	.112	1.736	.056
	5	4.340	.140	2.170	.070
	10	8.680	.280	4.340	.140
Crab grass hay	1	.897	.022	.428	.006
	2	1.794	.044	.856	.012
	3	2.691	.066	1.284	.018
	4	3.588	.088	1.712	.024
	5	4.485	.110	2.140	.030
	10	8.970	.220	4.280	.060
Millet hay (cat tail)	1	.895	.062	.421	.009
	2	1.790	.124	.842	.018
	3	2.685	.186	1.263	.027
	4	3.580	.248	1.684	.036
	5	4.475	.310	2.105	.045
	10	8.950	.620	4.210	.090
Johnson grass hay	1	.89	.03	.41	.008
	2	1.78	.06	.82	.016
	3	2.67	.09	1.23	.024
	4	3.56	.12	1.64	.032
	5	4.45	.15	2.05	.040
	10	8.90	.30	4.10	.080
Corn silage	1	.21	.009	.11	.007
	2	.42	.018	.22	.014
	3	.63	.027	.33	.021
	4	.84	.036	.44	.028
	5	1.05	.045	.55	.035
	10	2.10	.090	1.10	.070
Sorghum silage	1	.239	.006	.149	.002
	2	.478	.012	.298	.004
	3	.717	.018	.447	.006
	4	.956	.024	.596	.008
	5	1.195	.030	.745	.010
	10	2.390	.060	1.490	.020
Soja bean silage	1	.258	.027	.087	.013
	2	.516	.054	.174	.026
	3	.774	.081	.261	.039
	4	1.032	.108	.348	.052
	5	1.290	.135	.435	.065
	10	2.580	.270	.870	.130

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbohydrates—Pounds	Fats—Pounds
Cowpea silage	1	.207	.015	.086	.010
	2	.414	.030	.172	.020
	3	.621	.045	.258	.030
	4	.828	.060	.344	.040
	5	1.035	.075	.430	.050
	10	2.070	.150	.860	.100
Sorghum (green)	1	.21	.006	.12	.004
	2	.42	.012	.24	.008
	3	.63	.018	.36	.012
	4	.84	.024	.48	.016
	5	1.05	.030	.60	.020
	10	2.10	.060	1.20	.040
Corn (green)	1	.21	.009	.12	.003
	2	.42	.018	.24	.006
	3	.63	.027	.36	.009
	4	.84	.036	.48	.012
	5	1.05	.045	.60	.015
	10	2.10	.090	1.20	.030
Oats (green) in bloom	1	.38	.03	.19	.01
	2	.76	.06	.38	.02
	3	1.14	.09	.57	.03
	4	1.52	.12	.76	.04
	5	1.90	.15	.95	.05
	10	3.80	.30	1.90	.10
Rye (green)	1	.23	.02	.14	.004
	2	.46	.04	.28	.008
	3	.69	.06	.42	.012
	4	.92	.08	.56	.016
	5	1.15	.10	.70	.020
	10	2.30	.20	.140	.040
Cabbage	1	.10	.02	.08	.004
	2	.20	.04	.16	.008
	3	.30	.06	.24	.012
	4	.40	.08	.32	.016
	5	.50	.10	.40	.020
	10	1.00	.20	.80	.040
Rutabagas	1	.11	.01	.08	.002
	2	.22	.02	.16	.004
	3	.33	.03	.24	.006
	4	.44	.04	.32	.008
	5	.55	.05	.40	.010
	10	1.10	.10	.80	.020

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbohydrates—Pounds	Fats—Pounds
Carrrots	1	.11	.008	.08	.002
	2	.22	.016	.16	.004
	3	.33	.024	.24	.006
	4	.44	.032	.32	.008
	5	.55	.040	.40	.010
	10	1.10	.080	.80	.020
Mangel Wurtzel	1	.09	.01	.05	.001
	2	.18	.02	.10	.002
	3	.27	.03	.15	.003
	4	.36	.04	.20	.004
	5	.45	.05	.25	.005
	10	.90	.10	.50	.010
Rape	1	.16	.02	....	.002
	2	.32	.04	....	.004
	3	.48	.06	....	.006
	4	.64	.08	....	.008
	5	.80	.10	....	.010
	10	1.60	.20	....	.020
Potatoes, Irish	1	.21	.009	.16	.001
	2	.42	.018	.32	.002
	3	.63	.027	.48	.003
	4	.84	.036	.64	.004
	5	1.05	.045	.80	.005
	10	2.10	.090	1.60	.010
Potatoes, sweet	1	.29	.009	.22	.003
	2	.58	.018	.44	.006
	3	.87	.027	.66	.009
	4	1.16	.036	.88	.012
	5	1.45	.045	1.10	.015
	10	2.90	.090	2.20	.030
Brewers' grains, wet	1	.24	.04	.09	.01
	2	.48	.08	.18	.02
	3	.72	.12	.27	.03
	4	.96	.16	.36	.04
	5	1.20	.20	.45	.05
	10	2.40	.40	.90	.10
Brewers' grains, dry	1	.92	.16	.36	.05
	2	1.84	.32	.72	.10
	3	2.76	.48	1.08	.15
	4	3.68	.64	1.44	.20
	5	4.60	.80	1.80	.25
	10	9.20	1.60	3.60	.50

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbo-hydrates—Pounds	Fats—Pounds
Rice (rough)	1	.89	....	....	....
	2	1.78	....	....	....
	3	2.67	....	....	....
	4	3.56	....	....	....
	5	4.45	....	....	....
	10	8.90	....	....	....
Rice (clean)	1	.87	....	....	....
	2	1.74	....	....	....
	3	2.61	....	....	....
	4	3.48	....	....	....
	5	4.35	....	....	....
	10	8.70	....	....	....
Rice bran (15 per cent hulls)	1	.90	.06	.37	.05
	2	1.80	.12	.74	.10
	3	2.70	.18	1.11	.15
	4	3.60	.24	1.48	.20
	5	4.50	.30	1.85	.25
	10	9.00	.60	3.70	.50
Rice polish	1	.89	.07	.60	.04
	2	1.78	.14	1.20	.08
	3	2.67	.21	1.80	.12
	4	3.56	.28	2.40	.16
	5	4.45	.35	3.00	.20
	10	8.90	.70	6.00	.40
Rice meal (pure bran)	1	.91	.09	.40	.06
	2	1.82	.18	.80	.12
	3	2.73	.27	1.20	.18
	4	3.64	.36	1.60	.24
	5	4.55	.45	2.00	.30
	10	9.10	.90	4.00	.60
Cane molasses	1	.78	....	.66	....
	2	1.56	....	1.32	....
	3	2.34	....	1.98	....
	4	3.12	....	2.64	....
	5	3.90	....	3.30	....
	10	7.80	....	6.60	....
Beet molasses	1	.79	....	.60	....
	2	1.58	....	1.20	....
	3	2.37	....	1.80	....
	4	3.16	....	2.40	....
	5	3.95	....	3.00	....
	10	7.90	....	6.00	....

TABLE III—CONTINUED.

FEEDS	Weight—Pounds	Dry Matter—Pounds	Protein—Pounds	Carbo-hydrates—Pounds	Fats—Pounds
Rice straw	1	.88	.03	.33	.01
	2	1.76	.06	.66	.02
	3	2.64	.09	.99	.03
	4	3.52	.12	1.22	.04
	5	4.40	.15	1.65	.05
	10	8.80	.30	3.30	.10
Buckwheat straw	1	.90	....	....	....
	2	1.80	....	....	....
	3	2.70	....	....	....
	4	3.60	....	....	....
	5	4.50	....	....	....
	10	9.00	....	....	....
Bermuda grass hay.........	1	.93	....	....	....
	2	1.86	....	....	....
	3	2.79	....	....	....
	4	3.72	....	....	....
	5	4.65	....	....	....
	10	9.30	....	....	....
Kentucky blue grass hay	1	.79	....	....	....
	2	1.58	....	....	....
	3	2.37	....	....	....
	4	3.16	....	....	....
	5	3.95	....	....	....
	10	7.90	....	....	....
Alfalfa (green)	1	.28	.04	.13	.005
	2	.56	.08	.26	.010
	3	.84	.12	.39	.015
	4	1.12	.16	.52	.020
	5	1.40	.20	.65	.025
	10	2.80	.40	1.30	.050
Cowpea (green)................	1	.16	.02	.09	.002
	2	.32	.04	.18	.004
	3	.48	.06	.27	.006
	4	.64	.08	.36	.008
	5	.80	.10	.45	.010
	10	1.60	.20	.90	.020

A FEW SAMPLE RATIONS WHICH MAY BE COMPOUNDED OF OUR AVAILABLE STOCK FOODS.

Information previously afforded in this bulletin is sufficient to enable the feeder to select for himself the different available stock-foods, and to arrange and balance them for his various needs.

To further assist him, however, we have given below a number of sample rations made up of materials given in Tables Nos. II and III.

It should be stated that in all of the rations mentioned, except when otherwise stated, the amount and proportion of the different materials are for the daily requirements of animals per one-thousand pounds live weight. In the case of single animals weighing more or less than 1,000 pounds, the amount of the food should be changed in proportion to their weight. This correction may be made by adopting the simple "rule of three."

Again, animals at work should have their day's ration divided into three parts and given morning, noon and night, with the greater bulk of the hay, or other roughage, along with the night feed. In the case of young, or idle, animals, this division is not so necessary, as they are generally allowed free access to food of some kind.

When work animals have "off" or idle days, their food should be reduced in quantity.

Animals doing light or medium work should have their food regulated, both as to amount and "balance," according to their needs, as can be seen by referring to the "standards" on Table No. 1.

When cattle are at pasture, only the concentrated part of their rations may be considered, as the former will take the place of the roughage mentioned in the sample rations.

When hogs (swine) have the run of a suitable pasture, the amount of their concentrated food may be reduced.

In order to ascertain the cost of any of the sample rations it is only necessary to make a simple calculation based upon the current prices of the materials used.

Rations for Horses or Mules per 1,000 Pounds Live Weight Doing Hard Work.

Food Materials.	*Pounds.*	*Total lbs.*
(1)		
Oats (grain)	13	
Peavine hay	15	28
(2)		
Cotton seed meal	3	
Corn meal, or corn and cob meal	11	
Corn fodder	13	27
(3)		
Cowpeas (grain)	4	
Oats (grain)	15	
Corn fodder	10	29
(4)		
Oats (grain)	15	
Mixed grass and clover hay	15	30
(5)		
Corn (grain)	8	
Oats (grain)	7	
Peavine hay	15	30
(6)		
Cotton seed meal	2	
Corn and cob meal	8	
Molasses (blackstrap)	11	
Peavine hay	15	36

(The above is something over the standard in amount, but may be used for a 1,200 pound to a 1,300 pound hard-working horse or mule.

(7)		
Molasses	15	
Alfalfa hay	16	31

(The above ration can best be used by absorbing as much of the molasses as possible with the hay, chopped. Its nutritive ratio is somewhat wider than the standard).

(8)		
Molasses	6	
Cotton seed meal	2	
Corn and cob meal	8	
Peavine hay	15	31

(9)	*Pounds.*	*Total lbs.*
Oats	2	
Rice bran	3	
Cotton seed meal	2	
Molasses	10	
Peavine hay	12	29

The following three rations are for a 1,200 pound horse or mule doing hard work:

(10)		
Cotton seed meal	1½	
Rice meal (pure bran)	8	
Corn	8	
Crabgrass hay	15	32½
(11)		
Corn	2	
Rice meal (pure bran)	8	
Molasses	8	
Alfalfa hay	15	33
(12)		
Corn	8	
Rice meal (pure bran)	8	
Peavine hay	15	31

(For all practical purposes, alfalfa, peavine and good lespedeza hays may be used interchangeably as roughage).

Rations for Milch Cows, per 1,000 Pounds Live Weight.

(1)	*Pounds.*	*Total lbs.*
Corn, or corn and cob, meal	4	
Peavine hay	25	29
(2)		
Rice bran	6	
Sweet potatoes	10	
Peavine hay	20	36
(3)		
Cotton seed meal	3	
Corn, or corn and cob, meal	3	
Corn stover	12	
Crabgrass hay	20	38

(4)	*Pounds.*	*Total lbs.*
Cotton seed meal	4	
Wheat bran	4	
Corn, or corn and cob, meal	6	
Corn fodder	18	32
(5)		
Cotton seed meal	4	
Corn, or corn and cob, meal	4	
Rice bran	4	
Peavine hay	15	27
(6)		
Cotton seed meal	3	
Corn and cob meal	3	
Corn stover	6	
Peavine hay	8	
Corn silage	40	60
(7)		
Cotton seed meal	3	
Rice bran	8	
Molasses	10	
Mixed grass hay	14	35
(8)		
Cotton seed meal	2	
Cotton seed hulls	6	
Peavine hay	10	
Corn stover	11	29
(9)		
Cotton seed meal	2	
Cotton seed hulls	15	
Peavine hay	20	37
(10)		
Cotton seed meal	2.6	
Cotton seed	2.2	
Wheat bran	1.3	
Corn, or corn and cob, meal	1.3	
Sorghum hay	13.5	
Corn silage	30	50.9

Rations for Fattening Cattle, per 1,000 Pounds Live Weight.

	Pounds.	*Total lbs.*
(1)		
Cotton seed meal	4	
Cotton seed hulls	22	26
(2)		
Cotton seed meal	6	
Molasses	10	
Cotton seed hulls	22	38
(3)		
Cotton seed meal	3	
Rice bran	8	
Molasses	10	
Mixed grass hay	14	35
(4)		
Cotton seed meal	4	
Cotton seed hulls	15	
Sorghum silage	25	44
(5)		
Cotton seed	8	
Rice polish	4	
Alfalfa or peavine hay	5	
Grass (Johnson) hay	10	27
(6)		
Cotton seed meal	5	
Corn, or corn and cob, meal	10	
Corn fodder	10	
Sweet potatoes	25	50
(7)		
Cotton seed meal	5	
Corn, or corn and cob, meal	8	
Cotton seed hulls	25	38

Rations for Fattening Hogs (Swine), per 1,000 Pounds Live Weight.

	Pounds.	*Total lbs.*
(1)		
Cow peas	9	
Corn meal	10	
Sweet potatoes	30	49

(2)	*Pounds.*	*Total lbs.*
Cow peas	8	
Wheat middlings	12	
Corn	21	41
(3)		
Corn	20	
Wheat middlings	40	60
(4)		
Rice meal (pure bran)	12	
Corn	22	
Skimmed milk (gravity)	37	71

Molasses may be fed to hogs, using it as a partial substitute for corn, or other carbonaceous concentrate.

The sample rations given for the different varieties of animals, besides those used in Louisiana, have been arranged from bulletins of the North Carolina and Florida Stations.

The Schuler Method of Producing Pork on the Farm.

Hon. Charles Schuler, State Commissioner of Agriculture and Immigration, has, for many years, been a successful raiser and feeder of hogs on his home property in DeSoto Parish, La., and as his method of feeding may, no doubt, be of interest to many, we give it in his own words:

"1st. I used pastures containing Bermuda and natural grasses, also a liberal supply of good water which can be easily supplied by either springs, wells or tanks. If your land permits the successful growing of alfalfa, you can furnish sows, shotes and pigs an ideal grazing spot to be used in connection with your pastures. In the absence of alfalfa, sow sorghum broad cast. I break and pulverize my land thoroughly about March 1st, then I sow the seed, using from 1-2 to 3-4 of a buhsel of seed per acre. Harrow in, and if your land is not too wet, run a light roller or drag over it. When the plant becomes about 10 inches high I allow my hogs to gain access, permitting them to run in and out as they please. I have run 56 head of sows, shotes and pigs, in connection with the pasture, on a two-acre patch. It will furnish good grazing until about July 15th. I feed in connection with sorghum, once a day at a regular time, two nubbins of corn to every head I have."

''I utilize such corn mainly, which is unfit to feed to my work stock, and which unless fed to the hogs, would become a comparative waste.

''2d. I have what is called three rotation fields of ten acres each, used mainly for experimental purposes, having in view the upbuilding of soil.

''In one of these I sow oats in October, which will furnish good winter pasture for calves, colts and pigs. After harvesting the oats, which usually takes place the latter part of May, I permit my hogs also to gather whatever waste grain there may remain in the field. About the middle of June this field is again planted in peas, Spanish goobers (peanuts), corn, sorghum and sweet potatoes. This crop is planted for hog feed late in the fall, the hogs doing their own gathering, and being allowed to feed on whatever variety of food they may prefer and as much of it as they choose.

''3d. Another of the rotation fields has been planted in corn in which at 'laying by time' were sown, broad cast, from 1 1-2 to 2 bushels of whippoorwill peas. The entire products of this field, except the peavine, is used in the fattening of hogs.

''About July 15th, when the peas begin to mature, I turn into this corn field all the shotes; these I expect to kill during the winter. I let them eat what, and as much as they please, having care, however, that at all times they have access to the pasture and water. They also have access to a mixture of salt, charcoal and hardwood ashes placed in covered troughs convenient for them to reach. When this field is exhausted, the corn fields planted with corn to feed work stock, every acre of which ought to be planted at 'laying by' time in peas, will have been harvested, and the hogs turned in to do the gleaning, after which the crop planted in the oat field will be ready to be occupied. By the adoption of this method you will not only raise and fatten hogs at a normal cost, but materially improve your soil.

''My farm is situated in the hills of DeSoto Parish. My main dependence for the physical up-building of the soil, is the droppings from stock. and pea culture.''

LOW-GRADE SUGAR-CANE MOLASSES—BLACKSTRAP.

There is, perhaps, no stock-feeding material that has aroused so much general interest amongst stockowners and feeders in this country as Louisiana low-grade molasses. Hitherto this residue of the sugar-making process seems to have been looked upon as too laxative in its effects for general use, when given in any considerable quantity, and has been usually limited to occasional administration in small quantities to animals for market or for exhibition purposes, and in some parts of the world, to relieve torpidity of the bowels in cattle.

It seems to have been the tendency of writers on molasses, as a food for horses, especially, to commend great caution in the use of this material on account of "looseness" of the bowels, as well as a diuretic effect induced by the potassium salts which molasses contains. Ware, in his most excellent work on "Molasses Feeding," states: "Among the numerous precautionary measures to be taken in feeding molasses, mention must be made of avoiding the exceptional molasses which contains saline elements." Col. Joshua A. Nunn, late Deputy Director General of the British Army Veterinary Department, quotes a Lieut. Bausil, of the French (?) Army, as saying that "great care has to be taken, as the salts of potash contained in molasses act as purgatives and diuretics." And such seems to have been the general impression, and doubtless the experience, of a great many stock owners who periodically made use of molasses to their animals. Hence, apart from its use as a laxative for cattle, its administration was limited almost solely to that of a condiment to induce horses to consume larger quantities of other food materials, or, in case of convalescence from some debilitating illness, as a tonic, pleasant to the taste and easy of digestion and assimilation.

To the ordinary purchaser and user of molasses, all varieties may look alike, and discrimination never once thought of. But, as to composition and physiological effect, there is a marked difference between the product of the beet sugar factory and that of the cane sugar factory. And, so far as our judgment goes, it is here where the discrepancy has arisen, giving the impression that molasses, as such, and without regard to its source, is purgative and diuretic in action, and hence requires to be "administered with extreme caution."

As illustrating the difference in chemical composition of the two varieties (cane and beet), we quote the following from a communication by Dr. Chas. A. Browne, Jr., late chemist of our Sugar Experiment Station, and who has had extensive experience in some of the best laboratories of both the United States and Germany:

	Cane Molasses (Blackstrap).	Beet Molasses.
Water	20.93	23.70
Cane sugar	30.73	46.70
Reducing sugars	29.67	0.60
Ash (salts)	8.85	13.20
Organic (non-sugar)	9.82	15.80

Dr. Browne adds: "The cane molasses as compared with the beet, contains 25 per cent. more of sugars. Another noteworthy fact is the excess of ash ingredients in the beet molasses. This is due to the presence of a large amount of potash salts which exert a strong purgative action upon the animal."

It would seem, that the somewhat general impression that molasses, from any source, is unduly laxative, must have been based upon the effect produced by the by-product from the beet factory, and not sugar-cane molasses, as there is abundant evidence in our own State of the harmless effect of blackstrap, so far as a purgative action is concerned. A very striking corroboration of this fact was given a few years ago on some extensive sugar estates in Fiji, where a large number of valuable work horses were fed, along with some grain, as high as 30 pounds per head per day without any untoward effects. After a time, however, this large quantity was reduced to 15 pounds, not by reason of any ill effect beyond a slight tendency to fatten, but because it was considered too risky an experiment with so much valuable stock. Contrary to expectation, the molasses diet produced constipation, instead of being laxative, and a few pounds of bran had to be given daily to keep the bowels in order. The ration, containing the 15 pounds of molasses, had been in use, at the time the matter was reported, for nearly two years with excellent results. It was fed daily to over 400 head of horses, averaging about 1,270 pounds.

The chief value of molasses as a food, is its economic source of carbohydrates (sugar), some idea of which may be had from the following:

	Diffusion Molasses.	Mill Molasses.
Carbohydrates (sugars)	67.07	65.90

From the above it may be seen how rich this hitherto-considered waste material is in the carbohydrate nutrient, and when it is known that these sugars are almost, if not completely, digestible, its enhanced value may still further be appreciated.

The custom of feeding molasses to the work stock on our large sugar estates has been adopted, in anything like systematic manner, only within the past few years. Previously, and when the price was extremely low, quantities of the material were run into large iron troughs, and the mules allowed free access to it; and, to some extent, this rather prodigal method still prevails. The true value of blackstrap as a food stuff has become more apparent of late years, however, and as the question of feeding economically has become one of considerable moment to our planters, it is being used more as an ingredient of the "balanced ration," and, as a rule, mixed with other concentrates.

Sugar Cane—The source of our "blackstrap" molasses.

Being desirous of collecting data, for the purpose of collation, with reference to the feeding of low-grade molasses on our sugar estates, the writer, last year, sent to a number of the larger planters a blank containing questions bearing upon the subject with the view of obtaining information which might be valuable for future reference.

The following is a reproduction of the question-blank and the replies obtained, which will, no doubt, be of interest:

(1) Do you feed "blackstrap" to your work horses or mules?

(2) To what number of mules do you feed molasses?

(3) Do you feed the molasses as an ingredient of a mixed ration, or by itself, and in what way?

(4) What quantity, by weight, do you feed at one time, and how much, approximately, does each animal consume per day?

(5) What other concentrates (grains, meals, bran, etc.) do you feed with the molasses, and what varieties of hay, or other roughage?

(6) How many times per day do you feed your mules during the working season?

(7) What is the total amount in weight of the food given each animal per day, viz., Concentrates? Roughage?

(8) Have you made any change in your system of feeding in the past five years, and if so, please state what the change has been?

(9) What is your observation as to the economy of feeding molasses?

(10) Since feeding molasses, and adopting a system more in keeping with the natural requirements of the animal, viz., a "balanced ration," what is your observation with regard to the health of your animals (dietetic ailments); their capacity for work, general condition, etc.?

SUPPLEMENTARY REMARKS.

REPLIES.

(The numbers preceding the replies agree with those preceding the questions).

Chatsworth Plg. and Mfg. Co., Ltd., Manchac, La.

(1) Yes. Our refinery does not turn out the genuine blackstrap. Our grade is higher.

(2) Sixty-five mules.

(3) We feed molasses, thoroughly mixed with 7 pounds of mixed feed (Delta), at the rate of half a gallon (6 lbs.) for the noon ration.

(4) We have never tried to feed more than half a gallon at a time, for the reason that our supply is very limited until we dry out hot-room thirds.

(5) Delta Feed. Have also fed crushed corn, 15 ears for each feed.

(6) We feed at noon and at night, but will admit that mules should be fed at 4 a. m., before going to work.

(7) Seven pounds Delta. We feed peavine hay during winter and alfalfa in summer. Have never weighed our hay ration, but feed them all they want, without wasting it.

(8) Have been crushing our corn for about a year in order to induce the mules to eat the cob and the shucks, which before then they would not do.

(9) We are feeding today at a cost of 19 cents per head a day since we are feeding molasses. Not many years ago we could not feed any cheaper than 35 cents and 40 cents a day per head.

(10) We consider that our mules are in better condition today than they have ever been. We have not had five cases of colic this year. In fact, in Febrnary last year we bought $25.00 of remedies, mostly colic medicine, and this year when the agent was around he was much surprised to see nearly all the remedies still left over. He did not sell us a dollar's worth.

SUPPLEMENTARY REMARKS.

Our experience in feeding molasses is not very wide, as we have fed it only partly last year and this season. We have found out this fact, however, that with whatever grain it is fed, it must be thoroughly mixed to obtain the desired effect. If left at will, and fed in a trough, as some planters feed, we have found out that some mules eat too much of it and are not hungry to eat much grain, therefore, do not get enough substantial food to stand hard work on a plantation. Whereas, other mules do not eat any at all if it is not mixed with their grain ration.

We have a good deal of confidence in molasses as a food for mules, and in future will keep a supply to feed every day in the year.

(NOTE.—The part of the food that is of any nutritive value has to enter the blood stream and must be in soluble form before being able to do so. The "substantial" part is that which passes off as excrementitious matter).—W. H. D.

A. W. Norman, Devall, La.

(1) Yes.
(2) One hundred and ten mules.
(3) Feed molasses mixed with ground corn, cob and shucks.
(4) About 12 pounds of molasses a day.
(5) Feed peavine hay until alfalfa is ready, usually about April 1st.
(6) Twice.
(7) Do not weigh roughage.
(8) Only change is in grinding our corn, which gives us a better feed, and is a big saving in quantity.
(9) Have not figured as to saving.
(10) Our mules are usually in good condition.

Belle Helene Plg. Co., Ltd., Belle Helene, La.

(1) Yes; to both mules and horses.
(2) One hundred and eighteen head.
(3) Mixed ration—crushed corn and cob and saturated with molasses.
(4) About 12 pounds at a feed. (This seems to include total concentrates).
(5) No other concentrates. Peavine hay.
(6) Twice with mixed feed. Hay enough for all night.
(7) Concentrates, 24 pounds. Amount of roughage not estimated.
(8) From solid corn in shucks to this mixed feed.
(9) About 50 per cent.
(10) Have lost none from colic; appear hardier; general appearance decidedly better.

Leonce M. Soniat, Dorceyville, La.

(1) Yes.
(2) One hundred head.
(3) Crush corn, shucks and cob, and pour molasses on same in trough.
(4) About one and one-half quarts.
(5) Hay fed dry, not weighed.
(6) Twice.
(7) Crushed corn 16 pounds. Roughage not weighed.
(8) Formerly fed corn in shucks.
(9) Takes about half the quantity of corn, cob and shuck being consumed which was formerly lost.
(10) Mules keep up very well, and there is less sickness.

LeBourgeois Bros., Mount Airy, La.

(1) Yes.
(2) Forty-three head.
(3) By itself in a large trough.
(4) About 7 pounds per day.
(5) Two pounds choice white oats; 3 pounds wheat bran; 2 pounds cotton seed meal, and 16 pounds choice Timothy hay, per day.
(6) Noon and night.
(7) Fourteen pounds; 16 pounds.
(8) Up to last year we fed oats and wheat bran (four gallons of the former and one gallon of the latter) and 12 pounds of hay.
(9) The balanced ration we are feeding at present, compared to the former, we find an economy of 11 cents per head per day.
(10) Since feeding the above balanced ration, which is the one suggested by you, we find the health and capacity for work first class.

E. H. Barton, Barton, La.

(1) Yes.
(2) Eighty-seven head.
(3) Mixed with corn.
(4) One-half gallon.

(5) Corn and peavine hay.
(6) Twice.
(7) Do not weigh feed.
(8) No change, except adding molasses.
(9) Do not know how much it saves, as we have used molasses such a short time, and not much of it.

Auguste Levert, Mark, La.

(1) Yes.
(2) One hundred head.
(3) Formerly allowed free access to molasses in a kettle; now feed one pint with crushed food, with much better success.
(6) Thrice.
(8) Answered in 3.
(10) Find mules more healthy since feeding molasses.

Leon Godchaux Co., Ltd., Reserve, La.

(1) Yes.
(2) Two hundred and ten head (two places).
(3) As a mixed ration. One-quarter gallon (3 lbs.) at a feed.
(4) Consume practically all.
(5) Six pounds corn, cob and shuck, ground, at a feed, with 5 pounds chopped peavine hay.
(6) Three times daily.
(8) Previous to three years ago, fed no molasses; fed stock but twice daily, and did not grind feed.
(9) Since feeding the new way, we have made enough feed on our plantations, and buy practically nothing.
(10) Mules have improved in every way.

Leon Godchaux Co., Ltd., Napoleonville, La.

(1) Yes.
(2) About two hundred and forty head.
(3) Feed molasses as an ingredient, mixed with the ground grain ration.
(4) One gallon divided into three feeds.
(5) Ground corn and cob, and cotton seed meal, with chopped peavine hay.
(6) Three times.

(7) Thirteen pounds plus the molasses. 15 pounds.

(8) Above system inaugurated some two years ago; previously fed oats and corn in the ear, and no molasses.

(9) That, in connection with cotton seed meal and ground corn and cob, molasses furnishes a perfectly balanced ration for a lesser price than any other ration.

(10) That the animals seem to sustain their hard work with more ease; that they seem to be in better condition, and very much less subject to colic and similar ills.

John T. Moore Planting Co., Schriever, La.

(1) Yes; systematically since 1896.

(2) One hundred and fifty to one hundred and sixty mules and twenty to twenty-five horses.

(3) As an ingredient of a mixed ration, as follows: one-half gallon at noon spread over ground corn and cob meal; one-half gallon at night spread over 10 pounds of hay and ground corn and cob meal.

(4) One-half gallon at feed, noon and night, each animal getting, approximately, one gallon per day.

(5) Rice bran or polish; corn and cob meal; cotton seed meal. Peavine hay, fodder corn, sorghum, alfalfa and cane tops. All roughage, save alfalfa, chopped.

(6) Three times per day, which system we have been following continuously for a year.

(7) Eighteen to twenty pounds. 10 to 12 pounds.

(8) In the past five years we have chopped all roughage save alfalfa; grinding the corn, and giving three feeds per day.

(9) It is difficult to estimate. In replacing corn, partially, in the ration, the saving in actual nutrients I should estimate at 15 cents per head per day.

(10) We were wont to estimate 8 to 10 per cent. loss per annum from dietetic ailments. Now we don't experience 1 per cent. loss from these maladies. The animals' capacity for work is largely increased, and the improved physical appearance attracts attention and provokes comment.

SUPPLEMENTARY REMARKS.

You already know my opinion on the subject of the "balanced ration." Besides the great saving in dollars and cents. not only in feed, but in the freedom from loss of animals, and in the increased efficiency of the animal organism, this replacing, or partial substitution of molasses, in place of corn, has made it possible to decrease *corn acreages* down to such a point as the latter no longer interferes with the fall-planting of the cane crop and its rapid and prompt cultivation in the Spring. By this reduced corn acreage, due to the "balanced ration" and cheap and economical feeding, it brings within reach the accomplishment of the *ideal* and this *ideal* is the planting of practically all of the cane crop in the fall. With a large acreage of solid peas, fall-planting can be inaugurated so soon as the summer rains cease—say between the 10th and 15th of August—allowing ample time, after plowing under of solid peas is accomplished, to harvest the small corn acreage, and do a tremendous fall planting.

Economic feeding brings us several paces nearer the millenium. Besides being *in line,* scientifically, itself, its practice makes possible the doing of many more things in the right way. Its application to our agricultural conditions, in my opinion, is a greater step than the utilization of bagasse as fuel, or the concentration of juices and syrups *in vacuo* has been in the economical operation of our sugar houses.

R. T. Gibbens, Baton Rouge, La.

(1) Yes.

(2) Fifty mules; 2 saddle horses, 2 colts, 4 milch cows, 4 calves and a lot of hogs.

(3) Feed molasses mixed with rice bran and cotton seed meal.

(4) About 8 pounds per mule; 6 pounds per horse, and about 4 pounds each, to cows or calves.

(5) Three pounds rice bran; 2 pounds cotton seed meal; 3 pounds oats. About 10 or 12 pounds choice timothy hay.

(6) Three times.

(7) Sixteen pounds. 10 or 12 pounds.

(8) Fed on home-raised corn and peavine hay in 1902; molasses, rice bran and cotton seed meal in 1903; corn and peavine hay in 1904, and am feeding the above mentioned ration now (Spring, 1905).

(9) I think I am saving about 4 cents to 8 cents per day per head of stock.

(10) The stock is healthier; in better condition and just as able to work as when fed on solid corn and peavine hay.

SUPPLEMENTARY REMARKS.

I do not mix oats with the molasses as the stock do not seem to digest them when mixed with molasses and bran. I feed oats in the morning; molasses, bran and meal at noon and at night. I think the reason the oats are not digested, when fed with molasses, is, that the stock become very fond of molasses and do not chew or crush the oats, but swallow them down whole with the molasses. I think better still if the oats were crushed and mixed with the molasses, although I have not tried that method. I do not find it any more trouble, or expense, in serving this feed, than any other, as the same man I used before feeds the stock now, and seems to be through with the feeding sooner and easier than before.

G. W. Sentell, Bunkie, La.

(1) Yes.

(2) Thirty-six head.

(3) Feed molasses in open trough.

(4) About one quart.

(5) Nearly altogether on ear corn, alfalfa and peavine hay.

(6) Noon and night.

(8) Only that we now feed molasses and have more alfalfa hay. Tried feeding cotton seed hulls and cotton seed meal with molasses, but it did not do.

(9) Think molasses an excellent adjunct to other feeds; saves its weght in corn or other concentrates.

(10) Am not using a scientifically-balanced ration.

SUPPLEMENTARY REMARKS.

Feed mules in open sheds and cannot say how much each consumes.

McCall and Legendre, McCall, La.

(1) Yes.
(2) Seventy-two head.
(3) Grind slipped-shuck corn, giving 8 pounds of the grain each day in two feeds (4 pounds each feed), which equals one ordinary pailful mixed with 2 quarts of molasses at 12 noon, and 3 quarts at night. They eat nearly all of it.
(5) Peavine hay for roughage.
(6) Twice daily.
(8) Fed 16 pounds grain, up to two years ago; since then, 8 pounds.
(9) Economy very great. Could not sell molasses before. Sell to ourselves now. Use one-half of crop for feed.
(10) We save from two to three mules each year. No more sick mules. *No colic at all—the curse of a sugar planter.* Credit molasses with 3 mules in 72 per year.

SUPPLEMENTARY REMARKS.

Would not be without molasses now under any conditions. No use to feed it in a trough alone—never could get enough into the stock. Now thy have to eat it and are in fine shape; better than when getting 16 pounds of grain.

C. C. Barton, Albemarle, La.

(1) Yes.
(2) One hundred.
(3) Mixed with ground corn with the shuck.
(4) Three-quarters of a gallon daily.
(5) Ground corn and peavine hay.
(6) Twice.
(7) Don't weigh.
(8) Changed from feeding corn and hay to the above mixed feed.
(9) The ground mixed feed cost two-thirds of what it cost to feed in the old way.
(10) The mules are healthier; shed their hair earlier in the Spring; do as much work as formerly, and have less colic.

C. S. Matthews, Matthews, La.

(1) Yes.
(2) Three hundred.
(3) Mixed ration; ground corn with molasses poured on it; also molasses alone in open trough.
(4) One quart per animal on the ground stuff, or as much as they want from the open trough.
(5) Ground corn, cob and shuck. Peavine hay.
(6) Twice per day.
(8) Formerly fed corn on cob, also a great deal of oats in summer; now feed ground corn and molasses and have used no oats this season as yet.
(9) Since feeding molasses and grinding our corn we save 50 per cent. on corn.
(10) Health first class. Capacity for work splendid.

SUPPLEMENTARY REMARKS.

Would advise all stock feeders to use ground food and give all the molasses the animals will eat. They will stop when they get enough.

McCall Bros. Pltg. and Mfg. Co., Ltd., McCall, La.

(1) Yes.
(2) One hundred.
(3) Mixed with ground corn, cob and shuck.
(4) Five quarts of molasses to each animal per day, or, 15 pounds.
(5) Corn only. Peavine hay, grass and alfalfa hay in season.
(6) Noon and night.
(7) Twenty-three pounds. What hay they can eat.
(8) No change.
(9) Saving of 25 per cent. in cost of feed.
(10) Health, working capacity and general condition as good as ever.

SUPPLEMENTARY REMARKS.

Mixed grain and molasses feeding seems a healthier feed, when feeding first quality grain, than when feeding solid grain.

H. C. Warmoth, Lawrence, La.

(1) Yes.
(2) Two hundred and twenty head.
(3) Mix the molasses with ground corn, cob and shuck, and pour it on top of a box full of uncut hay.
(4) About 18 pounds each per day.
(5) Nothing but corn and hay.
(6) Twice daily.
(7) Ten pounds ground corn, cob and shuck; 18 pounds of molasses. All the hay they will eat.
(8) Have been feeding as above for one year only.
(9) Think we save about half the cost of feeding.
(10) We have no sick mules from colic, or other diseases, common to animals.

SUPPLEMENTARY REMARKS.

We want to get as much molasses into the mules as they will take.

J. Supple Sons Pltg. Co., Ltd., Bayou Goula, La.

(1) Yes.
(2) Ninety.
(3) Feed the molasses thoroughly mixed with ground corn, cob and shuck.
(4) About 1 quart of molasses to 2 quarts of crushed corn.
(5) Crushed corn. All the hay (peavine) they will eat. Later, alfalfa and green oats.
(6) Noon and night.
(7) Three pounds molasses; weight of grain not given. All the hay mules can eat.
(8) Been feeding crushed corn and molasses for two years. Previously fed ear corn in shuck.
(9) Reduction in feed bill from 15 to 20 per cent.
(10) Have found the general condition of mules very much bettered. They are in nice shape; better able to stand hard work and have had very few mules sick with colic.

SUPPLEMENTARY REMARKS.

Am well pleased with our way of feeding molasses and crushed feed.

Charlton R. Beattie, Thibodaux, La.

(1) Yes.

(2) Eighty-five head.

(3) Pour molasses over ground corn, with which, at times, is mixed rice bran and cotton seed meal.

(4) Twelve pounds per day to each animal.

(5) Corn. Peavine hay, principally, with fresh crop of alfalfa as it is cut in the field.

(6) Three times.

(7) Twenty pounds to 30 pounds. 12 pounds.

(8) Yes; have commenced the feeding of molasses, and have tried to adopt a more balanced ration.

(9) Very economical, costing only a fraction per pound of its equivalent in grain.

(10) Have been fortunate in having little loss from disease in last few years, and, speaking generally, the mules have kept in excellent condtion.

The Trosclair and Robichaud Co., Ltd., Thibodaux, La.

(1) Yes.

(2) About 150 head.

(3) Mixed with crushed corn.

(5) Sometimes use rice bran. Peavine hay; later, alfalfa.

(6) Twice.

(7) About a regular water-bucketful (2 1-2 gallons) each per meal. All the hay they can consume at night.

(8) Used to feed dry corn and peavine hay alone, cutting each ear in about three pieces; now we grind corn; cob and shucks.

(9) Save fully one-third of our corn, thereby allowing us to make all the feed needed on the plantation.

(10) Mules are in better health; keep fat, and are as strong, if not stronger, than when we fed the old way.

V. and J. A. Berthelot, Hohen Solms, La.

(1) Yes.

(2) Two hundred and twenty-five head.

(3) Mixed ration.

(4) Five pounds twice per day.

(5) Crushed corn. All peavine hay they want; later, alfalfa and sorghum.
(6) Twice per day—thrice during grinding season.
(7) Sixteen pounds. All the hay they can eat.
(8) Crushing of corn and feeding molasses.
(9) Saving of about 20 per cent. of grain.
(10) General condition and health much improved.

Miles Planting Co., Burnside, La.

(1) Yes.
(2) Four hundred and fifty head.
(3) As an ingredient, by having it poured on the grain feed in the feed troughs.
(4) One gallon (12 lbs.) per head per day, which is all consumed.
(5) Ear corn. Peavine hay and alfalfa.
(6) Three times.
(7) Twenty pounds. 10 pounds.
(8) Change to the use of final molasses, started in 1903.
(9) About one-third is saved in cost over the original system in feeding without molasses.
(10) The capacity for work is as efficient as ever. The absence of colic is very noticeable among our mules.

John Dymond, Belair, La.

(1) Yes.
(2) Eighty head.
(3) Both ways; in a few shallow tanks, and also mixed with cut hay. The mules prefer the latter.
(4) Average consumption per day, 15 pounds per mule.
(5) Corn or oats. Bermuda grass hay.
(6) Twice, ordinarily—noon and all night. In May and June, a special feed in morning.
(7) Twenty-two pounds. 10 pounds.
(8) No change, except to combine molasses with cut hay.
(9) An economy of two-thirds of ordinary cost.
(10) In better condition than ever before, because of the greater food supply and the special effect of molasses.

The J. M. Burguieres Co., Ltd., New Orleans, La.

(1) Yes.
(2) Some 200 head.
(3) Molasses placed in a tank where the mules eat of it at will.
(4) Twelve pounds per day.
(5) Corn, oats, rice bran, cotton seed meal. Peavine hay.
(6) Twice.
(8) Instead of all corn and peavine hay, we now feed corn, oats, rice bran, molasses, cotton seed meal, peavine hay, sorghum and alfalfa.
(9) One of the best feeds, being cheap, and materially reduces quantity of other feeds.
(10) Mules in better shape; able to do more work, and percentage of sickness and death materially reduced.

SUPPLEMENTARY REMARKS.

Molasses as a mule feed is indispensable.

The Rose Hill Sugar Co., Abbeville, La.

(1) Yes.
(2) Seventy-eight head.
(3) Mixed ration; spread on the ear corn in trough.
(4) Approximately 3 pounds per mule daily.
(5) Ear corn in shuck, chopped or ground. Peavine hay and second crop rice.
(6) Noon and at sundown.
(7) Twenty-seven pounds, including cob and shuck. 10 pounds of hay.
(8) Practically no change.
(9) Saving of 20 to 40 per cent. in cost of feed. Average of 27 per cent. saved on the Company's three plantations.
(10) Have never used a "balanced ration" systematically. Have been feeding molasses almost continuously since 1884, and have always had healthy stock, ready and able to work at all times.

SUPPLEMENTARY REMARKS.

We never allow our stock to pasture. Keep them constantly in lot, when not at work, to avoid, as far as possible, charbon, which is frequently prevalent in this vicinity. Approximate cost per head per day is 19 3-4 cents.

H. G. Morgan, St. Rose, La.

(1) Yes.
(2) Fifty head.
(3) Molasses mixed with ground corn.
(4) Twelve pounds.
(5) Ground corn. Peavine hay.
(6) Three times.
(7) About 25 pounds. 6 pounds peavine hay.
(8) Originally fed oats or ear corn. Introduced molasses feeding about two years ago.
(9) Simply marvellous. Fully 40 per cent. saving, if not more.
(10) Stock in splendid condition at all times.

SUPPLEMENTARY REMARKS.

We feel that we have one of the best molasses feed systems in plantation practice. Our stables are specially arranged for such feeding.

G. B. Reuss, Hohen Solms, La.

(1) Yes.
(2) One hundred and sixty head.
(3) Mixed ration. Ground corn with shuck and cob, a small quantity of rice bran, and all the molasses that same will absorb.
(4) Eighteen pounds per day, per head.
(5) Ground corn, cob and shuck, rice bran. Peavine hay ad lib.
(6) Twice.
(7) Eighteen pounds molasses plus the grain. Hay (?)
(8) System inaugurated about four or five years ago, with no material change since then, with the possible exception of an increase in the amount of molasses.
(9) Very satisfactory.
(10) Mules are in excellent condition. Work six full days each week.

John R. Todd, Foster, La.

(1) Yes.
(2) One hundred and sixty head.
(3) Fed by itself, and kept in open vessels.
(4) Mules eat all they want.
(5) Corn, oats and cotton seed meal. Peavine hay.
(6) Twice.
(8) No change.
(9) Saves about 25 per cent. of the grain.
(10) Health good.

Judge Emile Rost, St. Rose, La.

(1) Yes.
(2) Fifty-five.
(3) As a mixed ration.
(4) Three pounds to 6 pounds, according to appetite of animal.
(5) Oats, bran and corn. Peavine hay.
(6) Twice.
(7) Sixteen pounds. 20 pounds..
(8) Only in the use of molasses.
(9) A saving of 30 to 40 per cent.
(10) Have only been feeding molasses about nine months and find stock keep up well at the same rate of work.

T. H. Roger, Thibodaux, La.

(1) Yes.
(2) One hundred and nineteen head.
(3) Mixed with ground corn.
(4) About 12 pounds per head per day.
(5) Ground corn and cotton seed meal. Peavine hay.
(6) Noon and night.
(7) Not stated.
(8) Used to feed with whole corn and peavine hay.
(9) About 25 per cent.
(10) Mules are greatly improved, and now keep healthy and in fine condition.

Cambon Bros., Boudreaux, La.

(1) Yes.
(2) Thirty head.
(3) Mixed with chopped corn.
(4) Eight pounds per head per day.
(5) Corn. Peavine hay.
(6) Noon and night.
(7) Sixteen pounds. 8 to 10 pounds.
(8) No change.
(9) Reduces concentrates to two pounds less each feed and facilitates digestion.
(10) In much better condition and capable of standing more work.

?———Glencoe, La.

(1) Sometimes.
(2) About 100 head.
(3) Both separately and sprinkled on top of other food.
(4) From one to three pounds twice daily.
(5) Corn, bran, cotton seed meal, Atlas feed. Peavine and crabgrass hay and cotton seed hulls.
(6) Noon and night.
(7) About 17 pounds. Doubtful.
(8) Very little economy; it tends to whet the appetite.
(10) Believe it lessens the liability to colic and acts as a gentle laxative.

SUPPLEMENTARY REMARKS.

Consider that molasses has about the same effect as early green feed—not a great amount of nutriment, but an appetizer.

Westover Pltg. Co., Ltd., Lobdell, La.

(1) Yes; for about 18 months.
(2) About 85 head.
(3) Mixed with grain in troughs.
(4) About 14 pounds per head per day.
(5) Crushed corn and cob, cotton seed meal. Peavine, crabgrass, alfalfa and timothy.
(6) Twice.
(7) Twenty-seven pounds. 10 pounds.

(8) Used to feed with corn raised on plantation and gave them all they would eat as long as it lasted. Then fed oats after corn gave out.

(9) It curtails the feed expense from 25 to 40 per cent.

(10) We do not have the colic since adopting our present system. As to capacity for work, cannot say that we have noticed any great difference.

Dr. C. P. Wilkinson, Jesuit Bend, La.

(1) Have done so.

(2) Twenty-five head.

(3) Mixed.

(4) About 6 pounds per head per day.

(5) Corn, oats, and rice polish. Bermuda and crabgrass, peavines and cane tops.

(6) Three.

(9) Not carefully investigated.

SUPPLEMENTARY REMARKS.

The dynamic stimulus of increased muscular force may be the most valuable feature of molasses feeding.

Dugas and LeBlanc, Paincourtville, La.

(1) Yes.

(2) Forty-eight.

(3) Mixed with ground corn, cob and shucks.

(4) About 12 pounds per head per day.

(5) Crushed corn, etc. Peavine hay.

(6) Noon and night.

(7) Twenty-two pounds. 12 pounds.

(8) We have changed on to crushed corn and molasses since January, 1904.

(9) Molasses and crushed corn, as fed now, saves about 25 per cent. of our feed.

(10) Our mules are in better health than before. Their capacity for work has not changed.

E. Cherbonnier, Colomb, La.

(1) Yes.
(2) Sixty mules and horses.
(3) Animals eat what they want out of open troughs.
(4) Have not kept account.
(5) Corn and oats. Peavine hay.
(7) Roughage not weighed.
(8) No change.
(9) Cannot say.
(10) Stock seem to be doing all right with feed as given.

Oak Lawn Sugar Co., Ltd., Irish Bend, La.

(1) Yes.
(2) One hundred and eighty head.
(3) Mixed ration.
(4) Nine pounds per head per day.
(5) Cotton seed meal, ground corn. Hay (peavine ?)
(6) Twice.
(7) Nineteen pounds. 13 pounds.
(8) Used molasses on hay for two years, afterwards on ground corn.
(9) Using one-third less grain than formerly, and expect to reduce it to one-half.
(10) Very much healthier, seldom having a case of colic. General health and condition of stock much improved.

Stanton Plantation (Millikin and Farwell), Algiers, La.

(1) Yes.
(2) One hundred and seventy-seven head.
(3) Mixed with oats.
(4) Twelve pounds per head per day.
(5) Oats. Hay (peavine ?)
(6) Twice. During grinding season, thrice.
(7) Twenty pounds. 14 pounds.
(8) No change.
(9) Saving of $6,000.00 per annum.
(10) Good.

SUPPLEMENTARY REMARKS.

Each mule is fed in separate stall. Stable is arranged so that troughs may be washed out, when necessary, with piping and hose.

J. J. Jacobs, Convent, La

(1) Yes.
(2) Eighty-two head.
(3) Mixed ration.
(4) A fraction over 21 pounds per head per day.
(5) Corn, cob and shucks. Alfalfa.
(6) Twice.
(7) 29.19 pounds. 16.70 pounds.
(8) Prior to two years ago, was accustomed to feed corn or oats and hay, with molasses loose in a trough where mules had free access.
(9) Reduced feed bill over 50 per cent.
(10) My stock have never been in healthier condition; more muscular; full of life and less susceptible of getting sick. I haven't lost a single mule in the last two years. and very seldom, if ever, hear of a case of colic.

SUPPLEMENTARY REMARKS.

The above ration is given to the mules during the heavy working season. On Sundays and on rainy days during the working season, when the mules are not at work, we eliminate grain entirely and give per mule, per day, about 15 pounds of molasses and 15 pounds of alfalfa hay. When the stock do light work, after the crop is laid by, or after grinding, for a month or two, the molasses and alfalfa hay constitute their daily ration.

John Hill, Port Allen, La.

(1) Feed a good grade of molasses, as we do not make blackstrap.
(2) About 120 head.
(3) By itself. Place in large narrow coolers and let mules eat as they want.
(4) About 9 pounds per head per day.
(5) Home-raised corn; otherwise, ground corn and oats. Peavine or choice timothy hay.
(6) Noon and night.
(7) Sixteen pounds. About 10 pounds.
(8) No change.
(9) Not stated.
(10) It keeps the mules in a much better condition. Certainly

believe in feeding molasses to mules, as I think it enables them to stand the summer better, retaining weight, and they do better work.

SUPPLEMENTARY REMARKS.

Even feeding molasses in a crude way, as I do, I consider one pound of it to be worth very much more than a pound of any kind of grain.

E. B. LaPice, Lauderdale, La.

(1) Yes.
(2) Fifty-two head.
(3) Mixed ration.
(4) Seven pounds per head per day.
(5) Ground corn, cob and shucks. Alfalfa.
(6) Noon and night.
(7) Twenty-seven pounds. 10 pounds.
(8) Yes; we grind feed, making the molasses more available.
(9) Ten per cent. saving; with alfalfa, greater.
(10) Very good health; work well; general condition good.

SUPPLEMENTARY REMARKS.

When possible, feed three times a day. Alfalfa and molasses a great help.

J. A. Provost, Jeanerette, La.

(1) Yes.
(2) Sixty head.
(3) Alone, and placed on corn.
(4) About 6 pounds per mule per day.
(5) Corn. Peavine hay.
(6) Noon and night. Double ration at night.
(7) Do not keep account per pound.
(8) No change.
(9) Find economy is great, as the mules don't eat so much corn nor hay.
(10) Health is good, and the animals work with courage.

Smedes Bros., Cade, La.

(1) Yes.
(2) Thirty-five mules and horses.
(3) By itself, and mixed with ground corn, cob and shucks.
(4) About 12 pounds.
(5) Ground corn, cob and shucks, rice bran. Roughage not stated.
(6) Thrice.
(8) No change. Have been feeding molasses for past 10 or 12 years.
(9) Saves about one-third in corn.
(10) Since feeding molasses have had less colic.

SUPPLEMENTARY REMARKS.

We feed everything, except chickens, on molasses.

W. J. Young, Centerville, La.

(1) Yes.
(2) About 18 head.
(3) Mixed ration.
(4) About 3 pounds.
(5) Oats and bran. Timothy hay.
(6) Morning and night.
(9) Find economy considerable.
(10) Working capacity increased, and the animals keep in better condition.

Henderson Barkley, Luling, La.

(1) Yes; both to mules, horses and cows.
(2) One hundred and fifty mules, bout 8 horses and 4 cows.
(3) Mixed ration.
(4) About 9 or 10 pounds.
(5) Crushed corn, cob and shucks. Peavine hay, young corn forage, sorghum, and grass hay.
(6) Twice.
(7) Concentrates (?). Feed all the hay mules will consume.
(8) Prevously fed on corn, or oats. Have been feedng as above for eighteen months.
(9) Above speaks for itself.
(10) Mules in better condition than ever.

John D. Minor, Houma, La.

(1) Yes; for four or five years.
(2) All of stock, viz., 300 mules and horses, 20 cows, 75 sheep.
(3) Mixed ration.
(4) Seven to eight and a half pounds per day.
(5) Corn and cob meal, cotton seed meal, sometimes rice or wheat bran. Cut shucks, peavine hay, sometimes alfalfa, sorghum and cut cane-tops.
(6) Noon and evening.
(7) Seventeen to 23 pounds. 16 to 20 pounds.
(8) Have stopped buying oats entirely, and feed as above.
(9) Saving over oats from one-third to two-thirds, according to price of materials and comparative cost of oats.
(10) Our stock have shown a marked improvement in every way, viz., general health, power to do work, and in looks.

J. M. McBride, Houma, La.

(1) "I feed my mules one gallon of molasses spread on their corn of my own raising."

In transcribing the above replies there may be one or two slight discrepancies, as our correspondents did not, in every case, adhere rigidly to the details of some of the questions. If any errors there be, however, we believe they are of but minor importance and do not materially affect the results as quoted.

In summarizng, we may state that the replies represent what is being done, in the matter of feeding blackstrap molasses, on forty-seven estates in the sugar belt of the State. Some planters think that molasses has "no nutritive value, but that it merely entices the animals to consume more of other materials with which it may be mixed, by rendering them more palatable." Still others who think that it is not of sufficient "solidity" upon which to expect the animals to perform hard work, and should, therefore, under such conditions, be replaced, to some extent, by a more solid and bulky food. Some feed molasses as an ingredient of a mixed ration; others, by itself, ad libitum, in an open receptacle; while still others adopt both methods.

Quite a few know the exact amount each animal consumes per day, as well as the other ingredients of the mixed ration, and can, therefore make a close computation as to the cost of feed; while a considerable number make guess work of it, and have no accurate conception of the amount utilized by the stock. Some feed molasses to all of the different varieties of domestic animals on their places, except chickens.

The fewer number of planters feed their animals three times per day; the majority twice.

The consumption of molasses, per head, per day, on forty-seven sugar estates, at the time the replies were sent in (during April, 1905), averaged just about ten pounds; the range being from two to three pounds to a fraction over twenty-one pounds. The very great majority concede to a considerable saving in the cost of the feed bills, ranging from 10 per cent. to 50 per cent. or more; and all seem to refer to the marked diminution in the number of cases of dietetic ailments, such as colic, etc., and the health, and, therefore, the capacity of the animals for work being very much improved; all of which should certainly be taken into consideration when estimating results from the standpoint of economy.

There can be no reasonable doubt, we think, that the salutary results obtained from the feeding of molasses, exhibited in the improved condition of the animals and their freedom from indigestion, colic, etc., likewise the great reduction in the number of fatalities, is due to its almost perfect digestibility, and having to depend but little, if at all, on preparation before reaching the true digestive organs—the stomach and intestines.

As to the quantity of molasses fed to the animal, that should depend, of course, upon the carbohydrate constituents of the other materials, in order to have the digestible nutrients approximately balanced.

Being the cheapest source from which to obtain digestible corbohydrates, however, and being in such readily digestible form, it would seem economy to supply the sugar-constituents of the food chiefly through molasses. But, there is not any economy in giving an over-supply simply because it is cheap and the animal will eat it. Wolff, the great German, to whom we are so much indebted for information on animal nutrition, states, that the addition of starch or sugar (they have the same chemical composition) to a diet of hay or straw, if it exceeds 10 per cent. of the dry fodder, decreases its digestibility, particularly of the albuminoids (protein). Hence we are shown the necessity for foods being properly balanced in their digestible nutrients to prevent the depressing effect of a large amount of carbohydrates on the digestion of protein—the nitrogenous element of the food.

With the evidence before us, gathered from the experiences of a number of sugar planters who have now used molasses for some time, we cannot but claim for it a very high feeding value. But, by itself, it is not, of course, a perfect food, as it contains only one, we may say, of the important elements of nutrition. It is a valuable food for at least three good reasons: (1) It is the cheapest source we have, at present, at least, of the carbohydrate-nutrient, viz., sugar; (2) It is extremely rich in carbohydrates, containing in the case of mill (blackstrap) molasses, about 65 per cent.; (3) The complete digestibility (about 100 per cent.) of its contained carbohydrates.

And, we are of the opinion that the marked success which has attended its adoption, is almost entirely due to the readiness with which it can be absorbed into the circulation of the animal.

It may have been observed from the replies, that, on two or three of the plantations, the mules were given green cane-tops as roughage. With regard to this, we will quote the ration (including green cane-tops) so successfully fed on the Fiji sugar estates, previously referred to, and allow the feeder to use his own judgment in the matter:

	Pounds.
"Molasses	15
Wheat bran	3
Corn	4

Cane-tops—as much as the animals could eat. The molasses were mixed with the bran and chopped cane-tops."

This per diem ration, as before stated, was fed to horses averaging 1.270 pounds in weight. The following is its composition per day and per 1,000 pounds live weight.

DigestibleProtein lbs.	Digestible Carbohydrates (including fat) lbs.
1.13	13.31

Nutritive ration ....1:11.8.

The above ratio is much wider than the standard for this class of animal, but, so far as the Fijian experience goes, the horses receiving this ration improved, both in health and in working condition.

Molasses being such a highly carbonaceous concentrated food, a roughage to feed with, and balance it, should be, more or less, highly nitrogenous. The majority of our sugar planters have two very valuable roughages of the latter class, viz., peavine hay and alfalfa hay, both of them being what is termed complementary to the molasses, on account of their nitrogenous character. Our chief object in calling attention to this fact here, is, to suggest the importance of care in the production of these two crops, so as to secure them in the best possible condition to be used as a feeding material, as either of them, when damaged, not only loses in nutritive value, but becomes dangerous to the health of the stock. And, besides, when not harvested at the proper time, is not nearly so nutritious, and, consequently, much reduced in value as a food stuff.

VALUATION OF FEED STUFFS BY "UNITS."

The Experiment Station is frequently asked regarding the valuation of feed stuffs by "units;" or, in other words, to place a standard value upon the "unit" of each of the three principal nutrients, as is done in the case of commercial fertilizers. This, however, is a difficult matter, if not impossible, as the questions of condition, palatability and digestibility enter into the feed stuff problem, whereas, the latter two factors, especially, do not affect that of the fertilizer. For instance, a rancid rice bran may analyze as high as a fresh sample, yet its composition would not offset its rancidity for feeding purposes. A spoiled cotton seed meal has no value as a feed stuff, although it may contain 40 per cent. protein by analysis. The factor of condition or palatability makes little or no difference, however, when computing the value of cotton seed meal as a fertilizer.

Again, as Prof. W. H. Jordan puts it: "The dry matter of stock foods is made up of ash, protein, carbohydrates and fats. We practically ignore the ash and base the value of a given food upon the other three classes of compounds, which are the same in number as the three useful ingredients of mixed fertilizers. Now, if we could find in the market a stock food supplying only a single ingredient, as is the case with fertilizers, we could from its composition and market price determine the cost of this ingredient. As a rule, however, these classes of nutritents must be bought in a mixed condition. All commercial stock foods, except, perhaps, one waste product from sugar production, are mixtures in varying proportions of protein, carbohydrates and fats. When we buy one we buy all three. Protein, starch, sugar or oils as found in commerce have become, through the necessary process of separation, too costly to be considered for stock-feeding purposes, and their prices in these forms are not a proper basis of calculation." It will be seen, therefore, that the problem is a difficult one to deal with, and, so far, has not been satisfactorily solved.

A stock food to be of any value at all must be sound, palatable and digestible, no matter what its chemical composition may be.

The writer desires to acknowledge valuable assistance rendered by Mr. R. C. Holtzclaw, assistant chemist of the Station, in connection with the tabulated work in this bulletin.

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Louisiana Bulletin No. 87. September, 1906.

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

BATON ROUGE.

ANALYSES

OF

COMMERCIAL FERTILIZERS

AND

PARIS GREEN.

J. E. HALLIGAN, B. S.

BATON ROUGE:
THE TIMES PUBLISHING COMPANY.
1906.

Louisiana State University and Agricultural and Mechanical College.

Baton Rouge, La., Sept. 1, 1906.

Col. Charles Schuler Commissioner of Agriculture and Immigration Baton Rouge La.:

My Dear Sir—I submit herewith the results of analyses of Commercial Fertilizers and Paris Green made in the laboratories of the station the past season, to be published as bulletin No. 87 of the Experiment Stations. The analyses have been made by Mr. J. E. Halligan and his assistants, who have given able and painstaking attention to every detail of the work. All of the men engaged in the laboratory are university graduates, all have proven exceptionally competent, and a high standard of accuracy has been maintained.

The new laboratory has greatly facilitated the work.

Very respectfully,

W. R. Dodson

Director.

COMMERCIAL FERTILIZERS.

J. E. Halligan.*

During the past season the following fertilizer analyses have been made at this laboratory:

Complete fertilizers	1,302
Fertilizers containing phosphoric acid and nitrogen, not tankages	40
Fertilizers containing phosphoric acid and potash	54
Acid phosphates	199
Bone meals	123
Tankages	372
Cotton seed meals	328
Chemicals	38
Miscellaneous	52
Total analyses	2,508

Paris Green.

There were also 73 samples of Paris Green analyzed and all were found to be above the guarantee of 50 per cent Arsenious acid. The average per cent of Arsenious acid in these samples ran 55.13 per cent.

All the samples received in this laboratory are given immediate attention, and are analyzed in the order in which they are received. The official work is given preference and private samples are analyzed *free of charge*, when in the opinion of the Director such samples are of benefit to the planters of this State.

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*With the assistance of R. C. Holtzclaw, J. A. Hall, A. B. Jeffrion and A. T. Felt.

The Valuation of Fertilizers.

We receive many inquiries regarding the valuation of commercial fertilizers. In computing the value of a fertilizer the following trade values may be considered:

Available phosphoric acid	5 cents
Potash	5 cents
Nitrogen	15 cents

Of course these values are not constant, but are steady enough for all practical purposes.

A fertilizer guaranteed 10 per cent of available phosphoric acid, 1.50 per cent of potash, and 2.47 per cent of nitrogen would be worth about $18.91 per ton.

200 pounds of available phosphoric acid, at 5 cents	$10 00
30 pounds of potash at 5 cents	1 50
49.40 pounds of nitrogen, at 15 cents	7 41
Ton value	$18 91

The freight and cost of mixing the ingredients to make the above fertilizer are not considered; but the above example will enable the purchaser to arrive at some conclusion concerning the value of his fertilizer.

Precautions.

In purchasing fertilizers be sure that the manufacturer has conformed with the law and has tagged his goods properly. Make him "state what he sells and sell what he states." To be more explicit, obtain the guarantee of available phosphoric acid, potash, and of nitrogen or ammonia.

It would be well for the purchaser not to let a high sounding name influence him in buying a fertilizer. Often those fertilizers with the most tempting names are very poor. The manufacturer depends often upon the name rather than the merits to sell his goods. The purchaser should pay close attention to the guarantee and see that it runs up to the same.

Complete Fertilizers.

Complete fertilizers, sometimes termed compound fertilizers, are used to a great extent in Louisiana. These fertilizers contain the three essential elements, viz., nitrogen, phosphoric acid and potash. They vary a great deal in their composition.

A great many manufacturers put out complete fertilizers under the head of super phosphates. The purchasers should not confuse these complete fertilizers with other brands of super phosphate which only contain phosphoric acid.

In the following tables the guarantees are placed just above the analyses in italics. Those constituents running below the guarantee are printed in heavy type.

Fertilizers Containing Nitrogen and Phosphoric Acid, not Tankage.

Most of this class of goods is used on the sugar plantations. There is so much potash present in the Louisiana soils, and owing to the fact that sugar cane does not require much of this element, the above fertilizers meet the requirements of this crop.

All samples branded as Cane Fertilizers should not contain nitrogen in the form of nitrates. Dr. Stubbs has ably demonstrated that nitrogen in this form is practically valueless for sugar cane.

Fertilizers Containing Phosphoric Acid and Potash.

Under this head come fertilizers made up of acid phosphate and potash, and dissolved bone and potash.

This fertilizer does not seem to be in great demand in this State owing to the high content of potash in the Louisiana soils.

Acid Phosphates and Superphosphates.

These fertilizers are prepared by treating bones and phosphatic rock with sulphuric acid.

It might be well to remember that in buying acid phosphates they are worth approximately one dollar per ton for every per cent of available phosphoric acid present; that is, an acid phosphate running 14 per cent available phosphoric acid, would be worth approximately $14.00 per ton. Of course the freight is not considered in the above example.

Bone Meals.

These fertilizers should be bought on their mechanical condition as well as on their guarantee. The same goods if ground fine will be more available to the plants than if coarsely ground. There is very little immediately available phosphoric acid in bone meals. It is practically all insoluble.

Tankage.

Tankage seems to be a very popular fertilizer for sugar cane and a great deal is used in this State.

This last year there was more tankage sold than ever before. A great number of tankages, especially those guaranteed 6.50 per cent phosphoric acid, and 10 per cent ammonia, showed poor mechanical condition. They caked up badly and proved to be very adhesive. It was impossible to use a distributer in applying these tankages to the soil, and they caused a great deal of annoyance in handling. After being dried they absorbed moisture on standing, and resumed their original caked up condition.

In the laboratory we found a great deal of sulphuric acid present in the above tankages which probably contributed to the poor mechanical condition.

All tankages are analyzed separately and given immediate attention on their receipt at this laboratory, as settlement between the seller and purchaser is made on the result of analyses.

Cotton Seed Meal.

This southern by-product is used a great deal on the Louisiana plantations for fertilizing purposes. It is either used alone or in conjunction with acid phosphate or other elements. Many of the manufacturers are introducing considerable quantities of hulls and lint in their meals. This deteriorates the value of the meal as a fertilizing material. In the future the purchaser should be sure to procure this article on a strict guarantee. He should not buy it just because it is cotton seed meal.

By perusing the following analyses of cotton seed meal, you will observe that they vary from 2.83 per cent nitrogen, which is equivalent to 3.44 per cent ammonia, to 7.55 per cent nitrogen, which is equivalent to 9.17 per cent of ammonia. A good meal should run at lease 6.50 per cent of nitrogen which is equivalent to 7.90 per cent of ammonia.

Chemicals, Refuse Salts, Etc.

These are impure chemical salts used for fertilizer ingredients. The principal chemicals under this head are nitrate of soda, muriate of potash, sulphate of potash, kainit, nitrate of potash and ammonium sulphate.

There are a very few of the above chemicals sold in Louisiana. Kainit and nitrate of soda seem to be the most popular.

COMPLETE

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee.	Number of samples below guarantee
Arcadia Cotton Oil and Manufacturing Co., Arcadia, La.	13	12	1
Cotton Fertilizer	8	7	1
Average analysis below guarantee			
Average analysis above guarantee			
Corn Fertilizer	5	5	
Armour & Co., Chicago, Ill.	5	4	1
Vegetable Grower	1		1
King Cotton	4	4	
Brookhaven Fertilizer Co., Brookhaven, Miss.	1	1	
New South	1	1	
Caddo Fertilizer Co., Shreveport, La.	170	100	70
Cotton	104	83	21
Average analysis below guarantee			
Average analysis above guarantee			
Corn and Vegetable	42	16	26
Average analysis below guarantee			
Average analysis above guarantee			
Special	3		3
Special Cotton (no guarantee)	1	1	
Star	18		18
Vegetable	1		1
Caddo sample no information)	1		1

FERTILIZERS

PHOSPHORIC ACID					Nitrogen (N)	Ammonia (N H 3)	Potash (K $_2$O)
Water Soluble	Reverted	Insoluble	Total	Available			
				10.50	*1.75*		*.50*
8.98	4.05	0.30	13.33	13.03	1.70	2.06	0.41
8.48	4.84	0.88	14.20	13.32	1.82	2.22	0.50
				7.00	*3.00*		*1.00*
6.83	3.40	1.18	11.41	10.23	3.21	3.89	1.11
				9.00	*2.50*		*3.00*
8.30	4.28	1.12	13.70	12.58	2.20	2.67	2.54
				8.00		*2.00*	*2.00*
7.15	3.55	1.18	11.88	10.70	1.87	2.27	2.17
5.50	*2.50*	*1.00*	*9.00*	*8.00*	*1.65*		*2.00*
6.20	3.29	0.51	10.00	9.47	1.65	2.00	2.38
6.00	*2.00*	*1.00*	*9.00*	*8.00*	*2.06*		*1.00*
7.22	4.81	0.75	12.78	12.03	1.82	2.20	1.15
6.15	2.75	0.66	9.56	8.90	2.18	2.64	1.16
4.00	*2.00*	*1.00*	*7.00*	*6.00*	*2.90*		*1.00*
5.17	2.25	0.64	8.06	7.42	2.88	3.50	1.09
4.38	2.37	0.68	7.43	6.75	3.13	3.79	1.05
4.00	*2.00*	*1.00*	*7.00*	*6.00*	*2.47*		*7.00*
4.57	2.14	0.55	7.26	6.71	2.79	3.38	3.69
7.38	3.03	0.52	10.93	10.41	1.74	2.12	0.91
8.00	*2.00*	*1.00*	*11.00*	*10.00*		*2.00*	*1.75*
7.13	3.31	0.79	11.23	10.44	1.63	1.96	1.63
6.00	*2.00*	*1.00*	*9.00*	*8.00*	*3.20*		*4.00*
6.50	4.47	0.56	11.53	10.97	2.92	3.54	4.09
8.00	*2.00*	*1.00*	*11.00*	*10.00*		*2.00*	*1.75*
7.73	3.29	0.51	11.53	11.12	1.84	2.24	0.91

	COMPLETE		
Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Capital Fertilizer Co., Jackson, Miss.	37	16	21
Cotton Elevator	7	7	
Fruit and Vegetable	1		1
Nonpareil	15	9	6
Average analysis below guarantee			
Average analysis above guarantee			
Red Star	8		8
Royal Cotton	6		6
Clinton Oil and Manufacturing Co., Clinton, La.	1		1
Cotton	5		5
Federal Chemical Co., Nashville, Tenn.	4	2	1
Daybreak Fertilizer	4	2	1
Average analysis below guarantee			
Average analysis above guarantee			
Gulfport Cotton Oil and Fertilizer Co., Gulfport, Miss.	44	41	3
C. S. M. Compound	9	9	
C. S. M. Compound	2	2	
C. S. M. Mixture	1	1	
Primo H. G. Blood and Bone	7	7	
Primo Raw Bone Superphosphate	4	1	3
Average analysis below guarantee			
Average analysis above guarantee			
Superphosphate	21	21	

FERTILIZERS

PHOSPHORIC ACID							
Water Soluble	Reverted	Insoluble	Total	Available	Nitrogen (N)	Ammonia (N H 3)	Potash (K 2O)
6.50	*1.50*	*1.00*	*9.00*	*8.00*	......	*2.00*	*2.00*
6.19	3.08	0.54	9.81	9.27	1.71	2.07	2.33
3.00	*3.00*	*1.00*	*7.00*	*6.00*	*3.00*	......	*4.00*
5.98	1.73	0.49	8.20	7.71	3.05	3.70	3.40
6.50	*1.50*	*1.00*	*9.00*	*8.00*	*1.65*	......	*2.00*
7.68	2.67	1.88	11.23	10.35	1.75	2.12	1.55
7.87	2.80	0.36	11.03	10.67	1.78	2.17	2.19
6.50	*1.50*	*1.00*	*9.00*	*8.00*	......	*2.00*	*2.00*
7.98	3.04	0.53	11.55	11.02	1.71	2.07	1.73
7.50	......	*1.00*	*10.50*	......	......	......	*1.80*
7.95	2.95	3.93	14.83	10.90	1.75	2.12	1.57
6.00	*2.00*	*.05*	*8.05*	*8.00*	*1.65*	......	*2.00*
7.30	2.92	1.00	11.22	10.22	1.54	1.86	2.08
8.00	......	*1.00*	*9.00*	*8.00*	*2.00*	......	*2.00*
7.08	3.14	4.06	14.28	10.22	1.82	2.22	1.69
6.28	3.78	1.73	11.79	10.06	2.00	2.42	2.33
6.00	*2.00*	*1.00*	*9.00*	*8.00*	......	*2.00*	*2.00*
7.14	2.13	1.19	10.46	9.27	1.74	2.10	2.52
5.00	*2.00*	*1.00*	*8.00*	*7.00*	......	*2.00*	*2.00*
5.70	1.75	0.35	7.80	7.45	2.06	2.50	2.62
......	*2.00*	*1.00*	......	......	......	*2.00*	*2.00*
7.93	3.66	1.09	12.68	11.59	1.85	2.25	2.00
8.00	*2.00*	*1.00*	*11.00*	*10.00*	......	*2.00*	*2.00*
8.46	2.09	2.45	13.00	10.55	1.88	2.27	2.21
6.00	*2.00*	*1.00*	*9.00*	*8.00*	......	*2.00*	*2.00*
7.06	4.90	2.73	14.69	11.96	1.66	2.01	1.91
6.75	3.06	1.64	11.45	9.81	2.10	2.55	2.51
6.00	*2.00*	*1.00*	*9.00*	*8.00*	......	*2.00*	*2.00*
6.61	2.77	2.67	12.25	9.58	1.73	2.10	2.37

COMPLETE

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Hazlehurst Oil Mill and Fertilizer Co., Hazlehurst, Miss.	63	59	4
Imperial	59	59	
Imperial	2		2
Diamond A	2		2
Homer Cotton Oil Co., Homer, La.	4		4
Claiborne Mixture No. 1	4		4
Jackson Fertilizer Co., Jackson, Miss.	12	9	3
Raw Bone Superphosphate	3	3	
Royal C	7	4	3
Average below guarantee			
Average above guarantee			
Superphosphate	2	2	
Meridian Fertilizer Co., Meridian, Miss.	81	78	3
Home Mixture	75	75	
Southern Guano	3	3	
Vegetable Grower	3		3
Minden Cotton Oil and Ice Co., Minden, La.			
North Louisiana Standard	7	7	

FERTILIZERS

PHOSPHORIC ACID							
Water Soluble	Reverted	Insoluble	Total	Available	Nitrogen (N)	Ammonia (NH_3)	Potash (K_2O)
7.50	*2.00*	*1.00*	*10.50*	*9.50*	....	*2.00*	*1.75*
8.24	2.66	0.92	11.82	10.90	1.78	2.17	2.16
5.00	*1.50*	*1.00*	....	....	*3.00*	....	*3.00*
5.48	2.76	0.56	8.80	8.24	3.09	3.75	2.76
1.50	*5.00*	*1.00*	*7.50*	*6.50*	*3.00*	....	*4.00*
3.63	1.43	0.64	5.70	5.06	3.62	4.39	4.59
8.00	*2.00*	*1.00*	*11.00*	....	*1.75*	....	*.50*
9.30	4.97	0.72	14.99	14.27	1.47	1.78	0.44
7.50	*2.00*	*1.00*	*10.50*	*9.50*	....	*2.00*	*1.50*
7.93	3.42	2.50	13.85	11.35	1.65	2.00	1.56
7.50	*2.00*	*1.00*	....	....	....	*2.00*	*1.80*
8.15	3.13	2.00	13.28	11.28	1.54	1.87	1.99
6.14	4.87	3.30	14.31	11.01	1.70	2.06	2.04
7.50	*2.00*	*1.00*	....	*9.50*	....	*2.00*	*1.50*
7.53	3.75	2.65	13.93	11.28	1.82	2.20	1.62
8.00	....	*1.00*	*10.50*	*9.50*	*1.65*	....	*1.50*
8.37	3.51	0.97	11.85	10.88	1.81	2.19	1.93
8.00	*1.50*	*1.00*	*10.50*	*9.50*	....	*2.00*	*1.50*
6.95	3.47	2.71	13.13	10.42	1.83	2.23	2.07
5.00	*1.00*	*1.00*	*7.00*	*6.00*	*2.50*	....	*5.00*
6.96	3.06	1.37	11.39	10.02	2.98	3.61	2.93
8.00	*2.00*	*1.00*	....	....	*1.75*	....	*.50*
8.27	4.37	0.54	13.18	12.64	2.17	2.63	.80

COMPLETE

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
New Orleans Acid and Fertilizer Co., New Orleans, La.	115	48	75
Ammo. Raw Bone Superphosphate	6	3	3
Average analysis below guarantee			
Average analysis above guarantee			
Ammo. Raw Bone Superphos. and Potash	2		2
Blood, Bone and Beef	7	4	3
Average analysis below guarantee			
Average analysis above guarantee			
Blood, Bone and Potash	30	22	8
Average analysis below guarantee			
Average analysis above guarantee			
Gold Dust	39	8	31
Average analysis below guarantee			
Average analysis above guarantee			
Goldsmith's Improved Mixture	38	13	25
Average analysis below guarantee			
Average analysis above guarantee			
Vegetable Grower	3		3
Planters' Fertilizer and Chemical Co., New Orleans, La.	66	29	37
Cotton and Corn	17	1	16
Average analysis below guarantee			
Average analysis above guarantee			
Golden Home Mixture	32	12	20
Average analysis below guarantee			
Average analysis above guarantee			
Home Mixture	1		1
Raw Bone Superphosphate	16	16	
Stubbs' Cotton and Corn	19		19
Superphosphate	1	1	
Vegetable	1		1

FERTILIZERS

PHOSPHORIC ACID					Nitrogen (N)	Ammonia (N H 3)	Potash (K 2O)
Water Soluble	Reverted	Insoluble	Total	Available			
7.00	*2.00*	*2.00*	....	*9.00*	*1.65*	....	*1.50*
4.80	3.40	0.30	8.50	8.20	1.66	2.01	1.43
8.55	2.81	0.46	11.82	11.36	2.33	2.82	1.84
7.00	*2.00*	*2.00*	....	....	*1.65*	....	*1.50*
10.33	2.99	0.87	14.19	13.32	1.34	1.62	0.91
7.00	*2.00*	....	*11.00*	*9.00*	*1.65*	....	*1.50*
5.68	2.97	0.78	9.43	8.65	1.68	2.04	1.15
7.48	3.85	0.77	12.10	11.33	2.40	2.92	1.50
7.00	*2.00*	*2.00*	*11.00*	*9.00*	*1.65*	....	*1.50*
6.68	1.93	1.44	10.05	8.61	1.83	2.21	1.42
7.47	3.21	0.48	11.16	10.68	1.92	2.32	1.72
7.00	*2.00*	*2.00*	*11.00*	*9.00*	*1.65*	....	*1.50*
8.21	2.29	0.57	11.07	10.50	1.58	1.92	1.29
8.49	1.91	0.42	10.82	10.40	1.97	2.38	1.78
7.00	*2.00*	*2.00*	*11.00*	*9.00*	*1.65*	....	*1.50*
8.01	2.29	0.65	10.95	10.30	1.57	1.90	1.40
7.51	2.49	0.28	10.28	10.00	1.92	2.32	1.78
4.00	*2.00*	*2.00*	*8.00*	*6.00*	*2.47*	....	*4.00*
5.70	1.79	0.22	7.71	7.49	2.47	3.00	3.70
7.00	*2.50*	*2.00*	*11.50*	*9.50*	....	*2.00*	*1.00*
9.31	2.63	1.38	13.32	11.94	1.42	1.72	1.63
8.30	2.08	1.96	12.34	10.38	1.70	2.06	1.74
7.00	*2.50*	*2.00*	*11.50*	*9.50*	....	*2.00*	*2.00*
8.88	2.65	1.38	12.91	11.53	1.52	1.84	1.61
....	....	....	....	....	....	....	*1.00*
8.68	2.88	0.93	12.49	11.56	1.66	2.02	1.60
7.00	*2.50*	*2.00*	*11.50*	*9.50*	*1.65*	....	*1.00*
9.80	3.12	1.96	14.88	12.92	1.30	1.59	1.36
7.00	*2.50*	*2.00*	*11.50*	*9.50*	....	*2.00*	*1.00*
8.10	2.36	0.98	11.44	10.46	2.31	2.81	1.39
5.00	*2.00*	*2.00*	*9.00*	*7.00*	....	*2.00*	*2.00*
8.73	3.00	1.10	12.83	11.73	1.45	1.75	1.94
7.38	3.20	0.50	11.08	10.58	1.92	2.33	1.83
7.00	*2.00*	*2.00*	*11.00*	*9.00*	*2.65*	....	*3.00*
8.05	3.00	1.38	12.43	11.05	2.38	2.90	2.85

COMPLETE

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Ruston Oil and Fertilizer Co., Ruston, La.	64	15	49
Corn King	12	5	7
Average analysis below guarantee			
Average analysis above guarantee			
Cotton King	52	10	42
Average analysis below guarantee			
Average analysis above guarantee			
Standard Guano and Chemical Co., New Orleans, La.	311	294	17
Blood, Bone and Meat	32	25	7
Average analysis below guarantee			
Average analysis above guarantee			
Blood, Bone and Potash	1	1	
Champion Farmers' Choice	80	80	
High Grade Sugar Cane	12	12	
McCall's Formula	23	17	6
Average analysis below guarantee			
Average analysis above guarantee			
Mississippi Home	21	21	
Orange Tree	1	1	
Rice Fertilizer	2	2	
Special Formulas	4	3	1
Analyses			
"			
"			
"			
Sugar Cane	10	10	

FERTILIZERS

PHOSPHORIC ACID					Nitrogen (N)	Ammonia (N H3)	Potash (K 2O)
Water Soluble	Reverted	Insoluble	Total	Available			
6.00	*2.00*	*2.00*			*2.00*		*2.00*
7.99	3.98	1.48	13.45	11.97	1.60	1.94	1.36
4.93	3.07	0.78	8.78	8.00	2.65	3.23	2.00
6.00	*2.00*	*2.00*	*10.00*	*8.00*	*1.75*		*2.00*
8.14	3.69	1.47	13.30	11.83	1.49	1.80	1.47
6.00	*2.00*	*2.00*	*10.00*	*8.00*	*1.75*		
8.13	3.12	1.08	12.33	11.25	1.92	2.33	1.34
7.00		*1.00*	*10.50*			*2.00*	*1.50*
8.03	3.09	2.63	13.75	11.12	1.76	2.13	1.10
7.29	3.55	1.82	12.66	10.84	1.78	2.16	2.84
7.00	*2.50*	*1.00*	*10.50*	*9.50*	*1.65*		*1.50*
6.68	3.99	1.78	12.45	10.67	2.20	2.67	1.62
7.00	*2.50*	*1.00*	*10.50*	*9.50*	*1.65*		*1.00*
7.42	2.95	1.56	11.93	10.37	1.86	2.26	1.45
8.50	*1.50*	*1.00*	11.00	*10.00*	*2.50*		*2.00*
8.85	2.96	1.44	13.25	11.81	2.51	3.04	2.04
7.00	*1.25*	*1.00*	*9.25*	*8.25*	*3.85*		*1.00*
4.05	2.31	1.04	7.40	6.36	3.85	4.68	1.93
7.53	2.65	3.75	13.93	10.18	3.86	4.69	1.37
7.00	*2.50*	*1.00*	*10.50*		*1.65*		*1.50*
7.89	2.79	1.47	12.15	10.68	1,65	2.00	2.28
		15.00			*2.75*		*3.00*
		14.44	19.18	4 74	3.06	3.71	3.69
7.00	*2.50*	*1.00*	*10.50*			*2.00*	*1.50*
7.05	4.42	1.56	13.03	11.47	1 80	2.18	1.52
				5.00		*5.00*	*2.00*
4.68	2.80	2.72	10.20	7.48	4.99	6.06	2.64
				8.00			*2 00*
6.28	2.32	1.15	9.75	8.60	4.70	5.70	2.48
				8.00			*2.00*
6.50	3.67	1.83	12.00	10.17	4 46	5.41	1.69
			6.00				*1.00*
			10.35		6.58	8.00	1.45
8.50	*1.50*	*1.00*	*11.00*		*2.50*		*2.00*
7.95	3.74	2.84	14.53	11.69	3.26	3.96	2.40

COMPLETE

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Standard Guano and Chemical Co--Continued. New Orleans, La.			
Standard Guano	1	1	
Superphosphate	118	116	2
Average analysis below guarantee			
Average analysis above guarantee			
Truck Grower	1		1
Vegetable	5	5	
Swift & Co., Chicago, Ill.	22	21	1
Cotton King	1		1
Cotton Plant	4	4	
Red Steer	13	13	
(No Information on the following.)			
Analyses	1	1	
"	2	2	
"	1	1	
Virginia-Carolina Chemical Co., Richmond, Va.	249	152	97
Ammo. Raw Bone Superphosphate	7	7	
Bone, Blood and Potash	15	13	2
Average analysis below guarantee			
Average analysis above guarantee			
Cotton Boll	22	4	18
Average analysis below guarantee			
Average analysis above guarantee			
Corn King Guano	1		1

FERTILIZERS

PHOSPHORIC ACID					Nitrogen (N)	Ammonia (NH_3)	Potash (K_2O)
Water Soluble	Reverted	Insoluble	Total	Available			
7.00	*2.00*	*1.00*	....	....	....	*2.00*	*1.50*
7.93	3.27	1.88	13.08	11.20	1.78	2.16	1.50
7.00	*2.50*	*1.00*	*10.50*	....	*1.65*	....	*1.00*
5.57	4.93	0.79	11.29	10.50	1.57	1.91	1.15
6.83	4.74	2.06	13.63	11.57	1.88	2.29	1.83
6.00	*2.00*	*1.00*	*9.00*	*8.00*	*3.50*	....	*7.00*
6.28	3.00	1.22	10.80	9.58	3.70	4.49	6.60
....	*1.00*	*1.00*	*2.00*	*1.00*	*3.00*	....	*5.00*
6.00	2.39	0.94	9.33	8.39	3.21	3.90	6.24
6.00	....	*1.50*	*10.50*	....	*2.00*	....	*2.00*
6.25	3.98	2.35	12.58	10.23	2.19	2.66	1.94
6.00	*2.00*	*1.00*	*9.00*	*8.00*	*1.00*	....	*1.00*
8.43	3.07	0.85	12.35	11.50	1.85	2.25	1.51
5.00	*2.00*	*1.00*	....	....	*1.59*	....	*2.00*
5.92	2.68	1.92	10.52	8.60	2.95	3.58	2.08
5.00	*2.00*	*1.00*	*8.00*	*7.00*	....	*2.00*	*2.00*
6.30	2.36	1.37	10.03	8.66	2.57	3.11	2.94
5.00	*2.00*	*1.00*	*8.00*	*7.00*	*1.65*	....	*2.00*
6.63	3.54	1.18	11.35	10.17	1.91	2.32	2.64
6.00	*2.00*	*1.00*	*9.00*	....	*1.60*	....	*1.00*
8.44	3.51	1.30	13.25	11.95	1.75	2.13	1.36
8.00	*2.00*	*2.00*	*12.00*	*10.00*	....	*2.00*	*1.50*
8.33	2.42	3.60	14.35	10.75	1.99	2.42	1.73
8.00	*2.00*	*2.00*	*12.00*	*10.00*	*1.65*	....	*1.50*
8.18	3.34	1.61	13.13	11.52	1.50	1.82	1.50
9.68	2.50	1.32	13.50	12.18	1.91	2.32	1.88
				8.00	*1.59*	....	*2.00*
7.50	1.96	2.59	12.05	9.46	1.68	2.04	1.75
9.25	4.26	0.64	14.15	13.51	1.72	2.09	2.32
6.00	*2.00*	....	....	....	*2.00*	....	*2.00*
7.48	3.26	1.64	12.38	10.74	2.00	2.43	1.22

COMPLETE

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Virginia-Carolina Chemical Co.—Continued. Richmond, Va.			
Garden and Truck Special	2		2
Hope Cotton Grower	1	1	
Mobile Double Eagle	50	14	36
Average analysis below guarantee			
Average analysis above guarantee			
Mobile Standard Guano	1		1
North Carolina Muck	1		1
Royal Ammo. Bone	1	1	
Royal H. G. Guano	11	3	8
Average analysis below guarantee			
Average analysis above guarantee			
Royal Vegetable	4		4
Scott's Ammo. Bone	10	10	
Scott's Gossypium Phospho	97	86	11
Average analysis below guarantee			
Average analysis above guarantee			
Scott's Meal Formula	10	8	2
Average analysis below guarantee			
Average analysis above guarantee			
Scott's State Standard	15	5	10
Average analysis below guarantee			
Average analysis above guarantee			
Truck Grower	1		1

FERTILIZERS

PHOSPHORIC ACID					Nitrogen (N)	Ammonia (NH_3)	Potash (K_2O)
Water Soluble	Reverted	Insoluble	Total	Available			
4.00	*2.00*	*2.00*	*8.00*	*6.00*	*4.94*	....	*4.00*
5.18	1.42	4.20	10.80	6.60	4.86	5.90	3.05
6.00	....	*2.00*	*10.00*	*8.00*	....	*2.00*	*2.00*
5.95	2.73	0.45	9.13	8.68	1.65	2.00	2.00
7.00	*2.00*	*2.00*	*11.00*	*9.00*	....	*2.00*	*1.50*
8.63	2.85	2.12	13.16	11 48	1.58	1.92	1.68
9.15	2.01	0.84	12.00	11.16	1.65	2.00	1.73
6.00	*2.00*	....	*10.00*	*8.00*	....	*2.00*	*2.00*
5.68	2 40	0.50	8.58	8.08	1.58	1.92	1.80
6.00	*2.00*	*2.00*	*10.00*	*8.00*	....	*2.50*	*6.00*
6.98	2.52	1.78	11.28	9.50	2.10	2.55	5 34
7.00	*2.00*	*2.00*	*11.00*	*9.00*	*1.65*	....	*1.00*
5.58	4.52	2.05	12.15	10.10	1.76	2.13	1.32
8.00	*2.00*	*2.00*	*12.00*	*10.00*	*1.65*	....	*1.50*
8.40	3.26	2.64	14.30	11.66	1.78	2.16	1.43
7.68	3.57	2.58	13 83	11.25	1.66	2.01	1.50
6.00	*2.00*	*2.00*	*10.00*	*8.00*	*2.47*	....	*4.00*
7.10	2.70	2.10	11.90	9.80	3.79	4.60	3.13
7.00	*2,00*	*2.00*	*11.00*	*9.00*	....	*2.00*	*1.00*
7.33	3.75	0.40	11.48	11.08	1.90	2.32	1.34
8.00	*2.00*	*2.00*	*12.00*	*10.00*	....	*2.00*	*1.50*
8.25	3.32	0.68	12.25	11.57	1.68	2.03	1.08
7.93	2.49	2.26	12.68	10.42	2.09	2.54	1.98
7.00	*2.00*	*2.00*	*11.00*	*9.00*	....	*2.00*	*1.00*
8.75	3.44	0.29	12.48	12.19	1.43	1.74	1.22
7.38	4.25	1.50	13.13	11.63	1.65	2.00	1.41
6.00	*2.00*	*2.00*	*10.00*	*8.00*	....	*2.00*	*2.00*
6.65	3.03	0.67	10.35	9.68	1.99	2.42	1.81
7.06	3.26	3.64	13.96	10.32	1.68	2.04	2.02
6.00	*2.00*	*2.00*	*10.00*	*8.00*	*2.50*	....	*6.00*
4.65	3.70	6.73	15.08	8.35	2.39	2.90	5.78

PHOSPHORIC ACID AND

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Clinton Oil and Manufacturing Co., Clinton, La.	3	1	2
Corn	2	......	2
Special No. 2	1	1	......
Gulfport Cotton Oil and Manufacturing Co., Gulfport, Miss.	18	8	10
*Primo Cane Grower	18	8	10
Average analysis below guarantee	......	......	......
" " " "	......	......	......
" " above "	......	......	......
" " " "	......	......	......
" " " "	......	......	......
" " " "	......	......	......
New Orleans Acid and Fertilizer Co., New Orleans, La.	17	3	14
Special Sugar Cane, No. 67	7	......	7
Special Sugar Cane, No. 1	1	1	......
Special Sugar Cane	8	2	6
Average analysis below guarantee	......	......	......
Average analysis above guarantee	......	......	......
Special Sugar Cane	1	......	1
Planters' Fertilizer and Chemical Co., New Orleans, La.			
Special No. 1	2	1	1
Average analysis below guarantee	......	......	......
Average analysis above guarantee	......	......	......

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*14 of the above 18 samples contain Nitrogen as Nitrates.

NITROGEN FERTILIZERS

PHOSPHORIC ACID					Nitrogen (N)	Ammonia (N H 3)
Water Soluble	Reverted	Insoluble	Total	Available		
4.03	*1.07*	....	*5.12*	....	*3.00*	....
5.68	2.46	1.92	10.06	8.14	2.58	3.12
7.20	*2.40*	*.08*	*9.68*	....	*2.00*	....
6.98	3.32	1.25	11.55	10.30	2.72	3.30
2.00	*2.00*	*1.50*	*5.50*	*4.00*	*7:00*	....
3.03	1 85	2.10	6.98	4.88	6.58	8.00
2.00	*2.00*	*1.50*	*5.50*	*4 00*	*7.00*	....
2.80	2.40	2.38	7.58	5.20	6.64	8.07
1.00	*1.00*	*3.00*	*5.00*	*2.00*	*6.59*	....
1.75	1.74	2.23	5.72	3.49	7.12	8.64
2.00	*2.00*	*1.50*	*5.50*	*4.00*	*7.00*	....
2.20	3.13	2.12	7.45	5.33	7.37	8.94
3.00	*2.00*	*1.50*	*6.50*	*5.00*	*6.00*	....
3.41	2 94	2.74	9.09	6.35	6.88	8.35
2.58	2.68	2.86	8.12	5.26	7.48	9.09
5.00	*2.00*	*1.00*	*8.00*	*7.00*	*5.00*	....
6.65	2.90	1.10	10.65	9.55	4.59	5.58
5.00	*2.00*	*1.00*	*8.00*	*7.00*	*5.00*	....
5.55	2.63	0.90	9.08	8.18	5.15	6.25
5.00	*2.00*	*1.00*	*8.00*	*7.00*	*5.00*	....
6.73	2 43	0.79	9.95	9.16	4.85	5.89
6.05	2.75	0.55	9.35	8.80	5.20	6.31
4.00	*2.00*	*1.00*	*7.00*	*6.00*	*8.00*	....
6.20	1.46	0.52	8.18	7.66	6.27	7.62
8.00	*2.00*	*2.00*	....	....	*6.61*	....
8.20	2.64	2.16	13.00	10.84	5.81	7.05
7.08	3.86	1.29	12.23	10.94	6.88	8.35

PHOSPHORIC ACID AND

Name of Brand and Manufacturer	Nnmber of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
New Orleans Acid and Fertilizer Co., New Orleans, La.	12	8	4
Dissolved Bone and Potash	12	8	4
Average analysis below guarantee			
Average analysis above guarantee			
Standard Guano and Chemical Co., New Orleans, La.	37	31	6
Acid Phosphate and Potash	1		1
Acid Phosphate and Potash	14	14	
Dissolved Bone and Potash	17	13	4
Average analysis below guarantee			
Average analysis above guarantee			
Acid Phosphate and Kainit	2	2	
High Grad. A. P. and Potash	3	2	1
Average analysis below guarantee			
Average analysis above guarantee			
Swift & Co., Chicago, Ill.			
(No information)	1		1
Virginia-Carolina Chemical Co., Richmond, Va.	4		4
Royal Compound	1		1
Royal Potash Compound	2		2
Capital Bone and Potash	1		1

POTASH FERTILIZERS

PHOSPHORIC ACID					
Water Soluble	Reverted	Insoluble	Total	Available	Potash (K_2O)
8.00	*2.00*	*2.00*	*12.00*	*10.00*	*2.00*
7.20	4.44	0.99	12.63	11.64	1.83
8.67	3.78	0.51	12.96	12.45	2.89
8.00	....	*1.00*	*11.00*	*10.00*	*4.00*
6.50	4 29	3.96	14.75	10.79	2.32
8.00	*2.00*	....	....	....	*2.00*
7.76	5.24	2.26	15.26	13.00	2.33
8.00	*2.00*	*1.00*	*11.00*	*10.00*	*4.00*
7.00	3.00	1.20	11.20	10.00	3.75
8.67	3.74	1.52	13.93	12.41	4.22
8.00	*2.00*	*1.00*	*11.00*	*10.00*	....
8.03	3.00	2.12	13.15	11.03	2.96
10.00	*2.00*	*2.00*	*14.00*	....	*2.00*
9.03	5.10	1 00	15.13	14.13	1.10
7.95	3.64	1.41	13.00	11.59	2.34
7.00	*2.00*	*1.00*	*10.00*	....	*4.00*
7.50	4.17	1.46	13.13	11.67	2.83
8.00	*2.00*	*2.00*	*12.00*	*10.00*	*2.00*
6.98	5.22	1.50	13.70	12.20	1.82
8.00	*2.00*	*2.00*	*12.00*	*10.00*	*4.00*
7.28	2.37	0.65	10.30	9.65	3.64
8.00	....	*2.00*	*12.00*	*10.00*	*2.00*
7.05	2.23	0.57	9.85	9.28	3.71

ACID

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Arcadia Cotton Oil and Manufacturing Co., Arcadia, La.			
Acid Phosphate	4	4	....
Caddo Fertilizer Co., Shreveport, La.			
Acid Phosphate	15	15	....
Capital Fertilizer Co., Jackson, Miss.			
Acid Phosphate	3	3	....
Federal Fertilizer Co., Nashville, Tenn.			
Daybreak Acid Phosphate	2	2	....
Gulfport Cotton Oil and Fertilizer Co., Gulfport, Miss.	5	5	....
Acid Phosphate	2	2	....
Acid Phosphate	2	2	....
Primo High Grade Acid Phosphate	1	2	....
Hazlehurst Oil Mill and Fertilizer Co. Hazlehurst, Miss.			
Acid Phosphate	3	3	....
Jackson Fertilizer Co., Jackson, Miss.			
High Grade Acid Phosphate	2	2	....

PHOSPHATES

PHOSPHORIC ACID				
Water Soluble	Reverted	Insoluble	Total	Available
....	....	....	....	*14.00*
12.60	3.98	1.35	17.93	16.58
14.00	*2.00*	*1.00*	*17.00*	*16.00*
14.74	3.06	1.38	19.18	17.80
11.03	5.01	0.66	16.70	16.04
8.00	....	*1.00*	*9.00*	*8.00*
9.60	4.43	1.97	16.00	14.03
....	....	*1.00*	*15.00*	*14.00*
....	....	1.44	19.43	17.99
14.66	4.51	1.03	20.20	19.17
12.00	*2.00*	*1.00*	*15.00*	*14.00*
13.55	4.33	1.92	19.80	17.88
10.00	*2.00*	*1.50*	*13.50*	*12.00*
12.93	4.62	0.79	18.34	17.55
12.00	*2.00*	*1.00*	*15.00*	*14.00*
12.08	4.44	5.46	21.98	16.52

ACID

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples. below guarantee
Meridian Fertilizer Co., **Meridian, Miss.**			
Southern Acid Phosphate	13	13	
Minden Cotton Oil and Ice Co., **Minden, La.**			
Acid Phosphate	2	2	
New Orleans Acid and Fertilizer Co., **New Orleans, La.**	34	34	
Crescent City Acid Phosphate	16	16	
Black Diamond Acid Phosphate	17	17	
High Grade Acid Phosphate	1	1	
Planters' Fertilizer and Manufacturing Co., **New Orleans, La.**	29	29	
Acid Phosphate	18	18	
Acid Phosphate	1	1	
Acid Phosphate	1	1	
High Grade Acid Phosphate	9	9	
Ruston Oil and Fertilizer Co., **Ruston, La.,**			
Acid Phosphate	2	2	
Standard Guano and Chemical Co., **New Orleans, La.**	44	44	
Acid Phosphate	40	40	
Acid Phosphate	3	3	
Acid Phosphate	1	1	

PHOSPHATES

PHOSPHORIC ACID				
Water Soluble	Reverted	Insoluble	Total	Available
12.00	*2.00*	*1.00*	*15.00*	*14.00*
11.59	3.85	1.06	16.50	15.44
10.00	*2.00*	*1.00*		
11.40	5.25	0.44	17.09	16.65
10.00	*2.00*	*2.00*	*14.00*	*12.00*
10.86	3.86	0.62	15.34	14.72
10.00	*2.00*	*2.00*	*14.00*	*12.00*
9.78	4.53	0.62	15.02	14.40
12.00		*2.00*	*18.00*	*16.00*
15.63	3.44	0.38	19.45	19.07
10.00	*2.00*	*2.00*	*14.00*	*12.00*
11.65	4.01	1.42	17.08	15.66
				14.00
10.83	4.27	2.25	17.35	15.10
				15.00
11.90	3.10	2.03	17.03	15.00
12.00	*4.00*	*2.00*		*16.00*
14.48	4.79	2.10	21.37	19.27
12.83	5.01	2.00	19.84	17.84
	2.00	*2.00*		
12.12	4.48	1.12	17.60	16.48
7.00	*2.50*	*1.00*	*10.50*	
13.48	4.10	0.89	18.47	17.58
10.00	*2.00*	*2.00*	*14.00*	*12.00*
14.80	3.55	1.20	19.55	18.35

ACID

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Swift and Co., Chicago, Ill.			
Cultivator (A. P.)	1	1	
Virginia Carolina Chemical Co., Richmond, Va.	40	37	3
Royal Acid Phosphate	1	1	
Royal Bone Superphosphate	2		2
Royal Dissolved Bone	4	4	
Scott's High Grade Acid Phosphate	15	15	
Superphosphate	16	15	1
Avarage analysis below guarantee			
Average analysis above guarantee			
Superphosphate	2	2	

PHOSPHATES

PHOSPHORIC ACID

Water Soluble	Reverted	Insoluble	Total	Available
11.00	*2.00*	*1.00*		*14.00*
11.43	3.94	1.81	17.18	15.37
10.00	*2.00*	*2.00*	*14.00*	*12.00*
10.68	4.26	1.66	16.60	14.94
12.00	*3.00*	*2.00*	*17.00*	*15.00*
9.03	4.31	1.21	14.55	13.34
10.00	*2.00*	*2.00*	*14.00*	*12.00*
11.68	4.15	3.02	18.85	15.83
12.00	*2.00*	*2.00*	*16.00*	*14.00*
11.75	4.42	2.88	19.05	16.17
12.00		*2.00*	*18.00*	*16.00*
10.53	3.98	2.19	16.70	14.51
10.98	5.04	2.32	18.34	16.02
12.00	*4.00*	*2.00*	*18.00*	*16.00*
12.45	5.10	2.20	19.75	17.55

BONE

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Armour and Co., Chicago, Ill.	2	2	....
Bone Meal	1	1	....
Bone Meal	1	1	....
New Orleans Acid and Fertilizer Co., New Orleans, La.			
Bone Meal	3	....	3
Standard Guano and Chemical Co., New Orleans, La.			
Ground Bone	107	107	....
Swift and Co., Chicago, Ill.	10	10	....
Bone Meal	9	9	....
Bone Meal	1	1	....
Sunset Cotton Oil Co., Sunset, La.			
No Information	1	1	....

MEALS

PHOSPHORIC ACID			Nitrogen (N)	Ammonia (N H 3)
Insol	Total	Available		
......	*24.00*	*10.00*	*2.47*	......
18.92	29.13	10.21	2.82	3.43
......	*24.00*	......	*2.47*	......
......	27.60	......	3.17	3.84
10.00	*28.00*	*18.00*	*3.00*	......
13.87	22.58	8.07	3.06	3.70
......	*18.50*	......	*2.50*	......
......	19.95	......	3.41	4.1 5
......	*25.00*	......	......	*3.00*
......	27.18	......	2.85	3.46
......	*20.00*	......	*2.47*	......
......	28.55	......	2.64	3.20
......	*18.50*	......	*2.50*	......
......	21.07	......	3.20	3.88

TANK

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Armour & Co., Chicago, Ill.	17	13	4
Tankage	1	1	
Tankage	4	4	
Tankage	1	1	
Tankage	1	1	
Tankage	1		1
Tankage	9	6	3
Average analysis below guarantee			
Average analysis above guarantee			
Caddo Fertilizer Co., Shreveport, La.			
Tankage	1		1
Jackson Fertilizer Co., Jackson, Miss.			
Tankage	11	10	1
Average analysis below guarantee			
Average analysis above guarantee			
Swift & Co., Chicago, Ill.	343	148	195
Tankage	90	57	33
Average analysis below guarantee			
Average analysis above guarantee			
Tankage	20	14	6
Average analysis below guarantee			
Average analysis above guarantee			

AGES

PHOSPHORIC ACID			Nitrogen (N)	Ammonia (N H 3)
Insoluble	Total	Available		
2.00	....	*2.00*	....	*8.50*
3.34	7.85	4.51	7.63	9.27
2.00	....	*2.00*	*8.20*	....
3.25	7.15	3.90	8.42	10.24
....	....	....	*8.30*	....
1.11	5.35	4.24	8.69	10.55
....	....	....	....	*10.00*
....	5.73	....	8.82	10.72
....	....	....	*8.00*	....
....	8.97	....	7.79	9.47
....	....	....	....	*12.00*
....	6.42	....	9.68	11.76
....	4.45	....	10.29	12.51
8.53	*13.82*	*5.29*	*5.41*	....
8.71	15.73	7.02	4.79	5.82
....	*9.00*	....	....	*7.00*
....	9.65	....	5.54	6.74
....	10.45	....	6.02	7.32
....	*5.00*	....	....	*8.00*
....	6.90	....	5.98	7.27
....	6.15	....	6.18	7.50
....	*4.50*	....	....	*7.00*
....	6.62	....	5.63	6.84
....	6.23	....	6.08	7.39

TANK

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee
Swift & Co.—Continued. **Chicago, Ill.**			
Tankage	30	2	28
Average analysis below guarantee			
Average analysis above guarantee			
Tankage	126	39	87
Average analysis below guarantee			
Average analysis above guarantee			
Tankage	57	22	35
Average analysis below guarantee			
Average analysis above guarantee			
Tankage	1		1
Tankage	6	4	2
Average analysis below guarantee			
Average analysis above guarantee			
Tankage	1	1	
Tankage	3		3
Tankage	2	2	
Tankage	1	1	
Tankage	2	2	
Tankage	1	1	
Tankage	1	1	

AGES

PHOSPHORIC ACID			Nitrogen (N)	Ammonia (N H 3)
Insoluble	Total	Available		
	2.50			*12.00*
	3.88		9.07	11.02
	5.53		9.95	12.10
	6.50			*10.00*
	6.83		7.94	9.64
	8.55		8.50	10.33
	5.50			*9.00*
	9.15		7.32	8.88
	6.43		7.57	9.20
	5.50			*8.00*
	6.48		6.27	7.62
	4.50			*11.00*
	1.94		8.70	10.56
	6.40		9.05	11.00
	6.87			*7.00*
	11.10		5.87	7.14
	4.50			*12.00*
	3.98		9.90	12.03
	6.87			*10.00*
	7.33		8.32	10.12
	6.50			*10.00*
	8.63		8.55	10.38
	9.00			*7.00*
	11.30		6.10	7.42
	2.50			*9.00*
	3.88		7.47	9.08
				9.00
	7.15		7.74	9.41

TANKAGES

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Phosphoric Acid	Nitrogen	Ammonia (N H 3)
No manufacturer given	2	2				
Tankage	1	1	....	4.13	9.69	11.77
Tankage	1	1	....	8.26	7.95	9.66

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
Abbeville Cotton Oil Co., **Abbeville, La.**					
Cotton Seed Meal	6	6		*7.00* 7.47	9.08
Altus Cotton Oil Co., **Altus, Oklahoma.**					
Cotton Seed Meal	1	1		*6.00* 6.48	8.12
Arkansas Cotton Oil Co., **Pine Bluff, Ark.**					
Cotton Seed Meal	4	4		6.95	*8.00* 8.45
Ashley Oil and Gin Co., **Wilmot, Ark.**					
Cotton Seed Meal	5	5		*6.60* 6.41	7.79
Breaux Bridge Oil Co., **Breaux Bridge, La.**	5	5			
Cotton Seed Meal	4	4		*6.55* 7.05	8.57
Cotton Seed Meal	1	1		6.16	7.48
F. W. Brode, **Memphis, Tenn.**					
Cotton Seed Meal	1	1		*6.10* 6.48	7.88
Caddo Fertilizer Co. **Shreveport, La.**	6	2	4		
Cotton Seed Meal				*5.00*	
Average analysis below guarantee				4.32	5.26
Average analysis above guarantee				*5.00* 5.16	6.26
Average analysis below guarantee				6.79	*8.50* 8.25

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
Canton Cotton Oil Co., Canton, Miss.					
Cotton Seed Meal	2	2		*6.58* 6.94	8.43
Capital City Oil Co., Baton Rouge, La.					
Cotton Seed Meal	2	2		*6.00* 6.33	7.70
Cinclare Cotton Oil Co., Cinclare, La.					
Cotton Seed Meal	6	6		*6.00* 6.58	8.00
Concordia Oil Mill Co., Vidalia, La.					
Cotton Seed Meal	1		1	*7.00* 6.80	8.27
Consumer Cotton Oil Co., Forest City, Ark.					
Cotton Seed Meal	2	2		*6.00* 6.69	8.13
De Soto Cotton Oil Co., Mansfield, La.					
Cotton Seed Meal	8	5	3		*8.00*
Average analysis below guarantee				6.41	7.78
Average analysis above guarantee				6.58	8.00
El Dorado Cotton Oil Co., El Dorado, Ark.					
Cotton Seed Meal	1	1		6.95	*8.00* 8.44

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
Enterprise Cotton Oil Co., Augusta, Ark.					
Cotton Seed Meal	1	1		*6.00* 6.76	8.20
Geoghegan & Co., Montgomery, Ala.					
Cotton Seed Meal	3	1	2		
Average analysis below guarantee				6.25	*8.00* 7.59
Average analysis above guarantee				6.58	8.00
Hazlehurst Oil Mill and Fertilizer Co., Hazlehurst, Miss.	32	32			
Cotton Seed Meal	28	28		*6.59* 7.49	9.10
Cotton Seed Meal	4	4		*6.00* 7.37	8.96
Hobart Cotton Oil Co., Hobart, Ark.					
Cotton Seed Meal	5	5		*6.00* 6.38	7.75
Homer Cotton Oil Co., Homer, La.					
Cotton Seed Meal	2	2		6.74	8.19
ta Bena Cotton Oil Co., Little Itta Bena, Miss.					
Cotton Seed Meal	1	1		*6 00* 6.10	7.42
Jonesboro Cotton Oil Co., Jonesboro, Ark.					
Cotton Seed Meal	1		1	*6.58* 6.20	7.53

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
Laurel Cotton Oil Co., Laurel, Miss.					
Cotton Seed Meal	1	1		*6.50* 7.03	8.55
Leighton Cotton Oil Co., Leighton, Miss.					
Cotton Seed Meal	1		1	*6.58* 5.74	6.98
Louisiana Cotton Oil Co., Shreveport, La.					
Cotton Seed Meal	2	2		6.95	8.45
Mississippi Cotton Oil Co., Greenville, Miss.	3	3			
Cotton Seed Meal	1	1		*6.49* 6.69	8.12
Cotton Seed Meal	1	1		6.88	*8.00* 8.35
Cotton Seed Meal	1	1		*6.00* 6.27	7.63
Moorhead Oil Mill, Moorhead, Miss.					
Cotton Seed Meal	1	1		*6.00* 6.39	7.76
Natchez Cotton Oil Co., Natchez, Miss.					
Cotton Seed Meal	4		4	*7.13* 6.88	8.36
New Iberia Mill and Mfg. Co., New Iberia, La.					
Cotton Seed Meal	15	15		*6.00* 7.15	8.69

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
New Orleans Acid and Fertilizer Co., New Orleans, La.					
Cotton Seed Meal	3		3	*6.59* 6.35	7.71
New Orleans Cotton Seed Oil Co., New Orleans, La.					
Cotton Seed Meal	14	12	2		
Average analysis below guarantee.				6.56	*8.00* 7.97
Average analysis above guarantee.				7.08	8.61
New Roads Oil Co., New Roads, La.					
Cotton Seed Meal	16	16		*6.00* 6.26	7.61
North Mississippi Oil Mills, Holly Springs, Miss.					
Cotton Seed Meal	1	1		*6.00* 6.42	7.80
Planters' Oil Mill, Tunica, Miss.					
Cotton Seed Meal	1	1		*6.50* 6.69	8.13
People's Cotton Oil Co., Lafayette, La.	21	21			
Cotton Seed Meal	11	11		*6.75* 7.32	8.90
Cotton Seed Meal	10	10		*6.51* 7.27	8.82
Pickens Cotton Oil Co., Pickens, Miss.					
Cotton Seed Meal	2	2		*6.59* 6.31	7.66

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
Planters' Oil Mill, Monroe, La.	10	9	1		
Cotton Seed Meal	9	8	1	*6.59*	
Average analysis below guarantee				6.34	7.71
Average analysis above guarantee				6.91	8:40
				6.00	
Cott[illegible] Seed Meal	1	1		6.54	7.95
Planters' Oil Co., Clarksdale, Miss.				*6.59*	
Cotton Seed Meal	1	1		6.73	8.17
Phoenix Cotton Oil Co., Memphis, Tenn.				*6.00*	
Cotton Seed Meal	4	4		6.63	8.06
					8.00
Cotton Seed Meal	1	1		6.64	8.07
Portland Oil Mill, Portland, Ark.				*6.50*	
Cotton Seed Meal	2	2		7.04	8.56
Red River Oil Co., Alexandria, La.				*6.17*	
Cotton Seed Meal	6	6		6.61	8.03
Roberts Cotton Oil Co., Jonesboro, Ark.				*6.00*	
Cotton Seed Meal	2	2		6.42	7.81

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
Rose City Cotton Oil Co., Little Rock, Ark.					
Cotton Seed Meal	1	1		6.18	7.51
Ruston Oil and Fertilizer Co., Ruston, La.					
Cotton Seed Meal	2	2		*6.60* 6.89	8.38
Sonia Oil Co., Alexandria, La.					
Cotton Seed Meal	1		1	*6.93* 6.46	7.83
Southern Cotton Oil Co.,	5	3	2		
Cotton Seed Meal	2	1	1		
Average analysis below guarantee				*3.50* 2.83	3.44
Average analysis above guarantee				3.54	4.30
Cotton Seed Meal	2	1	1		
Average analysis below guarantee				*6.58* 6.36	7.74
Average analysis above guarantee				6.68	8.11
Cotton Seed Meal	1	1		*6.00* 6.33	7.70
St. Landry Cotton Oil Co., Opelousas, La.					
Cotton Seed Meal	10	3	7		
Average analysis below guarantee				6.39	*8.00* 7.76
Average analysis above guarantee				6.59	8.00

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
St. Martins Oil Mill, St. Martins, La.					
Cotton Seed Meal	3	3		*6.05* 6.87	8.33
Standard Guano and Chemical Co., New Orleans, La.					
Cotton Seed Meal	2	2		*6.47* 7.55	9.17
Summit Gin and Improvement Co., Summit, Miss.	2	2			
Cotton Seed Meal	1	1		*6.00* 6.94	8.43
Cotton Seed Meal	1	1		*6.92* 7.03	8.54
Sunset Cotton Oil Co., Sunset, La.					
Cotton Seed Meal	7	7		*6.00* 6.90	8.40
Texarkana Cotton Oil Co., Texarkana, Ark.					
Cotton Seed Meal	1	1		7.01	*8.50* 8.52
Union Oil Co., Bunkie, La.	68	37	31		
Cotton Seed Meal (Bunkie, La.)	16	14	2		
Average analysis below guarantee				*5.76* 5.61	6.81
Average analysis above guarantee				5.76	7.00
Cotton Seed Meal (Bunkie, La.)	9		9	6.01	*8.00* 7.30
Cotton Seed Meal (Bunkie, La.)	2		2	*6.17* 5.84	7.10

COTTON SEED MEAL

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H 3)
Union Oil Co.—Continued. Monroe, La.					
Cotton Seed Meal (W. Monroe, La.)	15		15		*8.00*
Average analysis below guarantee				6.41	7.79
Average analysis above guarantee				6.63	8.05
Cotton Seed Meal (Shreveport)	3		3	*6.59* 6.20	7.53
Cotton Seed Meal (Vidalia)	1	1		*6.59* 6.72	8.17
Cotton Seed Meal	4	4		*5.76* 6.31	7.67
Cotton Seed Meal	18	18		*6.59* 6.60	8.02
Washington Cotton Oil Co., Washington, La.					
Cotton Seed Meal	11	11		*6.00* 6.29	7.65
J. L. Wells, Memphis, Tenn.					
Cotton Seed Meal	7	7		*6.10* 6.51	7.92
Winona Oil Mill Co., Winona, Miss.					
Cotton Seed Meal	2	2		*6.00* 6.98	8.48

CHEMICALS

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (NH_3)	Potash (K O)
Caddo Fertilizer Co., Shreveport, La.	3		3			
Kainit	1		1			*12.00* 9.84
Nitrate of Soda	2		2	*16.00* 15.78	19.17	
Capital Fertilizer Co., Jackson, Miss.,	2	1	1			
Muriate of Potash	1		1			*50.00* 47.48
Nitrate of Soda	1	1		*15.00* 15.48	18.80	
Hazlehurst Oil Mill & Fertilizer Co., Hazlehurst, Miss.	4	3	1			
Kainit	3	3				*12.00* 12.06
Kainit	1		1			*12.00* 11.88
New Orleans Acid and Fertilizer Co., New Orleans, La.	2	2				
Muriate of Potash	1	1				*50.00* 51.26
Nitrate of Soda	1	1		*16.00* 16.00	19.45	
Standard Guano and Chemical Co., New Orleans, La.	22	22				
Kainit	14	14				*12.00* 13.52
Muriate of Potash	6	6				*45.00* 48.36
Nitrate of Soda	2	2		*15.00* 15.29	18.57	

CHEMICALS

Name of Brand and Manufacturer	Number of samples analyzed	Number of samples above guarantee	Number of samples below guarantee	Nitrogen (N)	Ammonia (N H) 3	Potash (K 2O)
Swift & Co., **Chicago, Ill.**	4	4				
					16.50	
Dried Blood	3	3		13.94	16.92	
				13.50		
Dried Blood	1	1		14.02	17.04	
Virginia Carolina Chemical Co., **Richmond, Va.**						
Nitrate of Soda	1	1			15.30	18.59

SUMMARY.

You will notice from the analyses computed in the tables of this bulletin, that most all of the samples of complete fertilizers ran above their guarantee in available phosphoric acid. Many of the samples ran below in potash. Most of the samples that ran low were deficient in the most valuable element, namely, nitrogen. The tendency is for the manufacturers to run their goods high in phosphoric acid and low in nitrogen, which costs about three times as much as phosphoric acid.

For the same reason many tankages ran up in phosphoric acid and those that ran low were low in nitrogen. Practically all of the acid phosphates and the bone meals ran above their guarantee.

The cotton seed meals vary a great deal in their composition.

Louisiana Bulletin No. 88. September, 1906.

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

BATON ROUGE.

ANALYSES

OF

COMMERCIAL FEEDING STUFFS

J. E. HALLIGAN, B. S.

BATON ROUGE:
THE TIMES PUBLISHING COMPANY.
1906.

Louisiana State University and Agricultural and Mechanical College.

Baton Rouge, La., Sept. 1, 1906.

Col. Charles Schuler Commissioner of Agriculture and Immigration Baton Rouge La.:

My Dear Sir—I submit herewith the results of analyses of Commercial Feeding Stuffs made in the laboratories of the station the past season, to be published as bulletin No. 88 of the Experiment Stations. The analyses have been made by Mr. J. E. Halligan and his assistants, who have given able and painstaking attention to every detail of the work. All of the men engaged in the laboratory are university graduates, all have proven exceptionally competent, and a high standard of accuracy has been maintained.

The new laboratory has greatly facilitated the work.

Very respectfully,

W. R. Dodson

Director.

COMMERCIAL FEEDING STUFFS.

J. E. Halligan.*

During the past season the following analyses have been made at this Station:

Cotton seed meal	588
Rice bran	177
Molasses feeds	330
Corn and oat feeds	411
Wheat bran and mixed feed	74
Miscellaneous	235
Total	1,815

We also made fibre determinations on 123 special samples.

EXPLANATION OF TERMS.

Protein—

This is the most necessary and most expensive ingredient of feeding stuffs. It comprises all of the nitrogen compounds present in the feed. It supplies the lean meat in the animal. The white of egg and curd of milk approach pure protein in composition. Without protein an animal cannot live.

Fat or Ether Extract—

This includes the oils, fats, waxes, resins and coloring matters present in feed stuffs. Their use is similar to the carbohydrates, although the fuel value of fat is greater.

Carbohydrates—

Sometimes called nitrogen free extract, include the starches, gums, sugars, pentosans and organic acids. These, together with the fat, comprise the fuel portion of the food.

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*With the assistance of G. H. Hardin, R. L. Menville and A. B. Joffrion.

Fiber—

This constitutes the most insoluble part of plants. It is the tough or woody part of plants, and is principally pure cellulose. Cotton fibre is almost pure fibre.

Water—

All feeding stuffs contain water. The amount of water present varies with the moisture content of the surrounding air. Most of the feeds contain from 5 to 15 per cent water.

Ash—

The ash, or mineral part of feeding stuffs, is that which is left after the feed is burned. It consists of lime, iron, potash, soda, magnesia, sulphates and phosphates.

Commercial Feeding Stuffs—

Under this head comes all the grains, seeds, their by-products and all products left after the preparation of human foods. Also by-products left after oil extraction.

VALUE OF THE FEED LAW.

The feed law requires all manufacturers to secure a license and place a guarantee upon their goods. By requiring this of the manufacturers there is afforded protection to the honest manufacturer and to the purchaser.

In carrying out this law the authorities wish the co-operation of all interested parties.

When in the opinion of the Director, good may be accomplished, suspicious samples, or other samples, will be analyzed free of charge for the accommodation of the purchaser.

We want to help all interested parties, and are glad to have any suggestions offered.

PRECAUTIONS.

By comparing the analyses in the following tables it will be seen that some of the feeds are much better than others, and more economical for feeding.

In judging feeds, note whether the protein and the fat reach their guarantee, and study the analyses and observe which feeds show adulteration.

In buying a feed obtain the prices from several manufacturers and consult the following tables in choosing your feed.

COTTON SEED MEAL.

This is the cheapest form of protein for the feeder to purchase.

Many of the manufacturers are introducing a considerable quantity of lint and hulls in their meals. They grind these meals so fine that it is often hard to detect the adulteration. Too great an addition of hulls and lint lowers the value of this valuable by-product for feeding purposes. A good meal should have a nutty odor, bright yellow color, and should be dry and finely ground. It should run at least 43 per cent protein, not over 10 per cent fat, and not over 9 per cent fibre. On account of the improvements in the manufacture of cotton seed oil many meals are showing a lower fat content than formerly. Too high a fat content is objectionable. In the following tables the meals vary from 18.88 per cent protein to 48.81 per cent protein.

In purchasing meals for feeding purposes avoid the dark colored samples. Do not buy a meal just because it is cotton seed meal. Purchase from a reliable mill or agent, and demand a guarantee.

In the following tables the meals are classified according to their protein content. There are some companies whose goods appear under more than one head:

RICE BRAN.

The rice brans offered for sale in this State are generally a mixture of rice bran and rice hulls. This adulteration of rice bran with rice hulls is sometimes extremely dangerous, when the per cent of hulls is high, as the hulls, on account of their composition and structure, produce gastric irritation, vomiting and finally death to the animal fed on the same.

According to Dr. Browne the formula used for calculating adulteration in rice bran is as follows:

Per cent hulls=3.33x per cent fiber—10).

Assuming that the hulls carry 40 per cent fibre and the bran runs 10 per cent fiber.

A sample of rice bran with 30 per cent fiber would be considered as having 66.60 per cent hulls.

Example: Per cent hulls=3.33x (30-10).

3.33x20—66.60 per cent.

Some of the samples reported in this bulletin contain even a greater per cent of hulls than in the above cited example.

From the results obtained in this laboratory rice bran should contain 12.50 per cent protein, 10 per cent fat, not over 10 per cent fibre, and the ash should not exceed 9 per cent. Any rice bran carrying over 10 per cent fibre and over 9 per cent ash shows signs of adulteration. In the following tables many brans analysed over 30 per cent fibre and 16 per cent ash. Such brans are dangerous for feeding purposes. Our feeders should use every precauton in purchasing this article.

MOLASSES FEEDS.

These feeds are very popular, and a large quantity of this class of goods is consumed in this State. They are made of mixtures of oat offal, refuse from flouring mills, ground corn stalks, finely ground hay, chaff from pipe factories, cockle seeds, rice hulls, malt sprouts, brewer's grains, cotton seed meal, rice bran and similar products; together with 10 per cent to 30 per cent molasses. There is a great deal of unscrupulous manufacturing in this class of goods, and many times the molasses is used to conceal poor goods.

In the manufacture of molasses feeds the simple mixing of the materials and molasses is not sufficient. Artificial drying must be resorted to. If these feeds are not dried sufficiently, fermentation sets in and spoils the feed. This is especially liable to happen in hot weather. Several carloads of these feeds have been shipped back to the manufacturers on account of decomposition.

A molasses feed should not carry over 12 per cent of moisture, and one running 10 per cent of moisture is preferable.

CORN AND OAT FEEDS.

These feeds are made up of factory by-products or waste products. They are mixtures of oat offal and broken corn or hominy, and sometimes contain other materials to bring up the protein content.

The results reported in the following tables show that these feeds vary from 5.40 per cent to 11.75 per cent of protein, from 1.45 per cent to 5.77 per cent of fat and from 8.47 per cent to 22.84 per cent of fibre.

WHEAT BRAN AND MIXED FEED.

Good wheat bran is a scarce article in Louisiana. Some of these brans are adulterated with oat offal, and contain screenings.

A good wheat bran should run at least 15 per cent protein and not more than 12 per cent fibre.

Many of the mixed feeds sold in this State are adulterated with ground corn cobs. These feeds came up to their guarantee in most all cases, but the consumer in buying these feeds pays fully as much as for the genuine article. A true mixed feed, under this head, is composed of bran and middlings in varying proportions. The consumer should demand a mixed feed carrying at least 16.50 per cent protein.

CONDIMENTAL FEEDS.

There have been very few samples of these feeds received in this laboratory. These feeds are a mixture of sulphur, salt, saltpeter, epsom salts, Glauber's salts, sodium bicarbonate, fenugreek seeds, fennel seeds, charcoal, red and black peppers, ground bone, venetian red and anise. This class of feeds generally carry attractive names and the manufacturers make great claims regarding their curative properties. These feeds are too expensive for the economical feeder.

If your animals are in good health they need no condition powders or tonics, and if they are sick it is cheaper to consult a veternarian.

COTTON

Averaging at least

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Abbeville Cotton Oil Co., **Abbeville, La.**	1	228	44.31	*43.00*
Canton Cotton Oil Co., **Canton, Miss.**	1	507	43.06	*38.75*
Centreville Cotton Oil Co., **Centreville, Miss.**	2 2	119 280	44.06 44.75	*40.00* *40.00*
Average	4		44.41	*40.00*
Hazlehurst Cotton Oil Co., **Hazlehurst, Miss.**	15 12 11 16 17 3 17 2 2 12 9	39 101 183 213 293 334 383 389 482 569 620	44.25 46.00 45 87 46.25 45.19 45.81 45.50 46 37 46.06 45.43 41.66	*40.00* *40.00* *40.00* *40.00* *40.00* *40.00* *40.00* *40.00* *40.00* *40.00* *40.00*
Average	116		45.31	*40.00*
Jackson Cotton Oil Co., **Jackson, Miss.**	1 2 1	226 135 607	43.18 44.12 42.63	*41 00* *41.00* *41.00*
Average	4		43.31	*41.00*
Jackson Cotton Oil Co., **Jackson, Miss.**	1	51	44.38	*38.75*
Kentwood Cotton Oil Co., **Kentwood, La.**	1 1	128 254	46.37 46.87	*40.00* *40.00*
Average	2		46.62	*40.00*

SEED MEAL

43 per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
12.51	*12.00*	21.00	*20.00*	7.78	*7.00*	8.25	6.15
8.88	*7.75*	26.92	*28.00*	7.75	*8.40*	6.47	6.92
9.42	*8.00*	24.33	*26.00*	7.27	*8.00*	7.58	7.34
7.34	*8.00*	22.98	*26.00*	10.02	*8.00*	8.42	6.49
8.38	*8.00*	23.65	*26.00*	8.64	*8.00*	8.00	6.92
7.74	*8.00*	26.69	*24.00*	7.05	*5.00*	7.47	6.80
8.29	*8.00*	25.46	*24.00*	7.08	*5.00*	6.28	6.89
7.73	*8.00*	25.40	*24.00*	6.85	*5.00*	7.45	6.70
7.53	*8.00*	24.14	*24.00*	6.70	*5.00*	8.63	6.75
7.68	*8.00*	24.05	*24.00*	6.54	*5.00*	9.87	6.67
7.56	*8.00*	25.81	*24.00*	7.13	*5.00*	7.01	6.68
7.59	*8.00*	24.20	*24.00*	7.45	*5.00*	8.42	6.84
7.43	*8.00*	24.27	*24.00*	7.41	*5.00*	7.59	6.93
7.33	*8.00*	25.49	*24.00*	7.19	*5.00*	7.30	6.63
9.17	*8.00*	22.72	*24.00*	7.04	*5.00*	9.02	6.62
8.01	*8.00*	27.53	*24.00*	7.44	*5.00*	8.52	6.84
7.82	*8.00*	25.07	*24.00*	7.08	*5.00*	7.96	6.76
7.85	*10.00*	26.36	*27.00*	8.09	*8.00*	7.19	7.33
8.42	*10.00*	25.74	*27.00*	7.39	*8.00*	7.45	6.88
9.94	*10.00*	23.98	*27.00*	7.24	*8.00*	9.28	6.93
8.74	*10.00*	25.36	*27.00*	7.57	*8.00*	7.98	7.04
8.22	*8.20*	25.39	*25.00*	6.74	*9.50*	8.40	6.87
11.33	*8.20*	22.75	*24.00*	5.12	*3.40*	7.45	6.98
9.87	*8.20*	22.56	*24.00*	5.53	*3.40*	7.96	7.21
10.60	*8.20*	22.66	*24.00*	5.32	*3.40*	7.71	7.09

COTTON

Averaging at least

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Louisiana Cotton Oil Co.,	3	26	46.40	42.00
Shreveport, La.	12	70	42.68	42.00
	8	154	44.44	42.00
	7	251	42.75	42.00
	5	295	42.00	42.00
	2	373	43.31	42.00
	4	400	43.81	42.00
	2	456	44.37	42.00
	6	570	42.25	42.00
	3	629	45.44	42.00
Average	52		43.75	42.00
Magnolia Cotton Oil Co.,	4	79	46.63	40.00
Magnolia, Miss.	9	199	45.50	40.00
	6	290	45.12	40.00
	7	382	46.50	40.00
	1	402	47.87	40.00
Average	27		46.32	40.00
Minden Cotton Oil Co.,	2	80	44.56	40.00
Minden, La.	4	209	45.50	40.00
	3	274	44.00	40.00
	1	369	44.12	40.00
	1	556	41.87	40.00
Average	11		44.01	40.00
New Orleans Cotton Seed Oil Co.,	1	255	44.18	40.00
New Orleans, La.	1	331	45.62	40.00
Average	2		44.90	40.00
People's Cotton Oil Co.,	1	236	45.87	40.00
Lafayette, La.	1	127	46.18	40.00
	1	23	43.14	40.00
Average	3		45.07	40.00

SEED MEAL

43 per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
8.93	*8.48*	24.74	*26.00*	5.96	*8.50*	6.67	7.30
8.81	*8.48*	25.71	*26.00*	7.37	*8.50*	8.26	7.17
8.90	*8.48*	25.40	*26.00*	6.30	*8.50*	8.43	7.53
8.70	*8.48*	23.96	*26.00*	6.35	*8.50*	10.38	7.86
9.10	*8.48*	22.86	*26.00*	5.93	*8.50*	9.98	10.13
8.87	*8.48*	24.18	*26.00*	6.85	*8.50*	9.14	7.65
8.77	*8.48*	26.00	*26.00*	6.47	*8.50*	7.42	7.53
9.11	*8.48*	25.41	*26.00*	6.05	*8.50*	7.44	7.62
9.29	*8.48*	25.04	*26.00*	6.75	*8.50*	9.32	7.35
8.71	*8.48*	24.38	*26.00*	6.32	*8.50*	7.05	8.10
8.92	*8.48*	24.77	*26.00*	6.43	*8.50*	8.31	7.82
9.57	*8.00*	22.23	*26.00*	6.04	*8.00*	8.79	6.74
8.55	*8.00*	24.66	*26.00*	6.82	*8.00*	7.78	6.69
8.25	*8.00*	24.54	*26.00*	5.73	*8.00*	9.63	6.73
8.82	*8.00*	23.22	*26.00*	5.78	*8.00*	8.68	7.00
9.70	*8.00*	21.26	*26.00*	5.77	*8.00*	8.37	7.03
8.98	*8.00*	23.18	*26.00*	6.03	*8.00*	8.65	6.84
11.11	*8.00*	23.74	*20.00*	6.13	*5.00*	7.68	6.78
8.60	*8.00*	25.86	*20.00*	4.35	*5.00*	8.49	7.20
10.22	*8.00*	24.58	*20.00*	5.20	*5.00*	8.67	7.33
11.70	*8.00*	24.44	*20.00*	4.97	*5.00*	7.60	7.17
9.12	*8.00*	24.56	*20.00*	7.15	*5.00*	10.12	7.18
10.15	*8.00*	24.64	*20.00*	5.56	*5.00*	8.51	7.13
8.62	*8.00*	23.79	*26.00*	7.97	*8.00*	8.55	6.89
8.74	*8.00*	23.98	*26.00*	7.07	*8.00*	8.16	6.43
8.68	*8.00*	23.88	*26.00*	7.52	*8.00*	8.36	6.66
8.55	*8.00*	24.09	*26.00*	7.32	*8.00*	7.86	6.31
8.60	*8.00*	24.18	*26.00*	7.64	*8.00*	6.95	6.45
9.73	*8.00*	26.23	*26.00*	9.29	*8.00*	5.78	5.83
8.96	*8.00*	24.83	*26.00*	8.08	*8.00*	6.87	6.19

COTTON

Averaging at least

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Standard Cotton Oil Co., **New Orleans, La.**	5	69	43.81	*40.00*
	1	167	44.50	*40.00*
	1	258	42.31	*40.00*
	1	315	41.25	*40.00*
	1	485	48.81	*40.00*
Average	9		44.13	*40.00*
Standard Guano Co., **New Orleans, La.**	2	106	43 12	*40.00*
Sunset Cotton Oil Co., **Sunset, La.**	2	133	43.37	*40.00*
Union Oil Co., **Gretna, La.**	5	104	44.56	*41.00*
	1	231	43.68	*41.00*
Average	6		44.12	*41.00*
Union Oil Co.,	7	31	43.09	*38.00*
Uniontown Cotton Oil Co., **Uniontown, Ala.**	1	129	43.18	*38.75*

Averaging 40 to 43

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Arcadia Cotton Oil Co., **Arcadia, La.**	3	28	44.38	*42.00*
	4	37	42.56	*42.00*
	1	291	41.65	*42.00*
	1	391	41.12	*42.00*
	1	490	43.43	*42.00*
	1	545	40.37	*42.00*
Average	11		42.25	*42.00*
Ashley Oil and Gin Co., **Wilmot, Ark.**	5	257	42.62	*42.00*
	1	312	40.84	*42.00*
Average	6		41.73	*42.00*

SEED MEAL

43 per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar anteed	% Found	% Guar-anteed	% Found	% Found
9.24	*8.00*	24.64	*26.00*	6.97	*8.00*	8.39	6.95
8.52	*8.00*	24.86	*26.00*	6.50	*8.00*	7.84	7.78
8.48	*8.00*	25.72	*26.00*	7.15	*8.00*	8.56	7.78
9.24	*8.00*	26.52	*26.00*	7.26	*8.00*	8.05	7.68
11.04	*8.00*	22.10	*26.00*	5.31	*8.00*	6.85	5.89
9.30	*8.00*	24.77	*26.00*	6.64	*8.00*	7.94	7.22
9.67	*8.00*	25.30	*26.00*	7.47	*8.00*	7.08	7.36
11.39	*8.00*	25.15	*26.00*	7.57	*8.00*	6.05	6.47
8.86	*10.00*	25.51	*27.00*	6.90	*8.00*	7.50	6.67
8.92	*10.00*	25.50	*27.00*	6.23	*8.00*	8.12	7.55
8.89	*10.00*	25.51	*27.00*	6.56	*8.00*	7.81	7.11
10.46	*10.00*	24.88	*27.00*	7.73	*9.00*	6.91	6.93
8.49	*8.20*	27.56	*25.00*	6.86	*9.50*	6.61	7.30

Per cent. Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar anteed	% Found	% Guar-anteed	% Found	% Found
7.29	*8.00*	26.76	*15.00*	7.73	*10.00*	6.90	6.94
7.74	*8.00*	26.08	*15.00*	8.18	*10.00*	8.34	7.10
7.73	*8.00*	26.18	*15.00*	7.35	*10.00*	9.78	7.31
10.60	*8.00*	26.11	*15.00*	6.39	*10.00*	9.15	6.63
6.95	*8.00*	27.78	*15.00*	8.10	*10.00*	6.76	6.98
7.33	*8.00*	27.07	*15.00*	7.42	*10.00*	10.68	7.13
7.94	*8.00*	26.66	*15.00*	7.53	*10.00*	8.60	7.02
8.09	*8.00*	24.02	*15.00*	9.44	*10.00*	8.83	7.00
7.84	*8.00*	25.91	*15.00*	8.80	*10.00*	9.45	7.16
7.97	*8.00*	24.96	*15.00*	9.12	*10.00*	9.14	7.08

COTTON

Averaging 40 to 43

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	 % Guaranteed
Brookhaven Cotton Oil Co., **Brookhaven, Miss.**	6	524	42.44	*38.00*
	2	575	41.63	*38.00*
	2	619	44.13	*38.00*
Average	10		42.73	*38.00*
Canton Cotton Oil Co., **Canton, Miss.**	1	55	44.18	*38.75*
	1	563	38.14	*38.75*
Average	2		41.16	*38.75*
Centreville Cotton Oil Co., **Centreville, Miss.**	1	566	42.87	*38.75*
Cinclare Cotton Oil Co., **Cinclare, La.**	1	126	41.81	*15.00*
	1	224	42.46	*15.00*
	2	571	41.74	*15.00*
Average	4		42.00	*15.00*
Colfax Cotton Oil Co., **Colfax, La.**	1	120	40.56	*40.00*
Columbia Cotton Oil and Manufacturing Co., **New Orleans, La.**	2	198	40.05	*37.87*
	1	308	39.68	*37.87*
	1	505	39.62	*37.87*
	1	608	40.91	*37.87*
Average	5		40.07	*37.87*
Cousumers' Cotton Oil Co., **Forest City, Ark.**	1	233	41.78	*42.00*

SEED MEAL

Per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
5.98	*7.00*	25.30	*32.00*	11.42	*12.00*	8.27	6.59
6.26	*7.00*	26.58	*32.00*	10.26	*12.00*	9.00	6.27
7.14	*7.00*	22.17	*32.00*	11.77	*12.00*	8.35	6.44
6.46	*7.00*	24.68	*32.00*	11.15	*12.00*	8.54	6.44
7.86	*8.20*	27.19	*25.00*	5.81	*9.50*	8.02	6.94
8.09	*8.20*	28.00	*25.00*	9.48	*9.50*	9.58	6.71
7.98	*8.20*	27.60	*25.00*	7.64	*9.50*	8.80	6.82
7.34	*8.20*	25.22	*25.00*	8.50	*9.50*	9.40	6.67
8.95	*10.00*	26.72	*18.00*	8.41	*12.00*	6.60	7.51
8.75	*10.00*	24.52	*18.00*	8.99	*12.00*	7.60	7.68
8.08	*10.00*	24.13	*18.00*	8.57	*12.00*	10.09	7.39
8.51	*10.00*	25.12	*18.00*	8.66	*12.00*	8.10	7.53
8.32	*8.00*	27.28	*26.00*	8.30	*8.00*	7.76	7.78
8.22	*10.70*	28.15	*26.57*	9.39	*8.87*	7.82	6.37
8.74	*10.70*	26.29	*26.57*	10.30	*8.87*	8.62	6.37
9.72	*10.70*	27.21	*26.57*	9.47	*8.87*	7.12	6.86
6.53	*10.70*	26.06	*26.57*	10.22	*8.87*	9.80	6.48
8.30	*10.70*	26.93	*26.57*	9.84	*8.87*	8.34	6.52
10.02	*8.00*	26.42	*20.00*	7.08	*9.00*	7.07	7.63

COTTON

Averaging 40 to 43

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
De Soto Cotton Oil Co., **Mansfield, La.**	1	123	43.25	*41.89*
	1	235	43.50	*41.89*
	1	313	42.37	*41.89*
	1	376	41.93	*41.89*
	1	457	45.15	*41.89*
	1	559	40.56	*41.89*
Average	6		42.79	*41.89*
El Dorado Cotton Oil Co., **El Dorado, Ark.**	2	168	42.37	*43.00*
Feliciana Cotton Oil Co., **St. Francisville, La.**	2	30	44.56	*40.00*
	1	171	42.25	*40.00*
	3	212	41.62	*40.00*
Average	6		42.81	*40.00*
Glen Allen Oil Mill Co., **Glen Allen, Miss.**	1	172	41.42	*38.75*
Grand Ecore Cotton Oil Co., **Natchitoches, La.**	1	137	39.75	*33.00*
	1	403	40.87	*33.00*
Average	2		40.31	*33.00*
Lecompte Cotton Oil Co., **Lecompte, La.**	2	208	40.68	*42.37*
Lexington Cotton Oil Co., **Lexington, Miss.**	4	102	40.69	*38.75*
Mississippi Cotton Oil Co., **Jackson, Miss.**	5	84	41.75	*41.00*

SEED MEAL

Per cent. Protein

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
8.80	*8.15*	26.29	*23.16*	7.16	*10.43*	7.59	6.91
8.10	*8.15*	26.93	*23.16*	6.83	*10.43*	7.79	6.85
7.60	*8.15*	27.86	*23.16*	7.29	*10.43*	8.15	6.73
8.25	*8.15*	26.32	*23.15*	7.58	*10.43*	9.50	6.42
8.27	*8.15*	25.73	*23.16*	6.93	*10.43*	7.31	6.61
8.00	*8.15*	26.65	*23.16*	8.80	*10.43*	9.26	6.73
8 17	*8.15*	26.63	*23.16*	7.43	*10.43*	8.27	6.71
7.82	*7.80*	26.33	*25.50*	8.31	*9.20*	8.50	6.67
10.26	*8.00*	22.95	*26.00*	8.08	*8.00*	7.35	6.80
11.50	*8.00*	22.85	*26.00*	7.85	*8.00*	8.70	6.85
9.70	*8.00*	24.49	*26.00*	8.36	*8.00*	9.00	6.83
10.49	*8.00*	23.43	*26.00*	8.10	*8.00*	8.35	6.82
8.53	*8.20*	27.52	*25.00*	7.80	*9.50*	7.40	7.63
10.47	*12.00*	27.43	*18.00*	8.17	*12.00*	6.73	7.45
6.79	*12.00*	27.33	*18.00*	9.13	*12.00*	8.52	7.46
8.63	*12.00*	27.33	*18.00*	8.65	*12.00*	7.62	7.46
12.35	*10.10*	24.55	*25.62*	6.98	*7.70*	8.25	7.19
8.58	*8.20*	28.86	*25.00*	7.10	*9.50*	7.40	7.37
9.71	*10.00*	26.01	*27.00*	7.85	*8.00*	7.37	7.31

COTTON

Averaging 40 o 43

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	 % Guar-
Mississippi Cotton Oil Co., Jackson, Miss.	2	143	42.06	*38.63*
	4	207	42.81	*38.63*
	2	318	40.69	*38.63*
	4	385	42.75	*38.63*
	2	399	40.43	*38.63*
	1	508	42.00	*38.63*
	2	572	41.43	*38.63*
	2	621	41.63	*38.63*
Average	19		41.72	*38.63*
Moorhead Cotton Oil Co., Moorhead, Miss.	1	285	40.06	*38.75*
Pickens Cotton Oil Co., Pickens, Miss.	2	81	40.00	*38.75*
Piedmont Cotton Oil Co., Faunsdale, Ala.	2	105	40.18	*38.75*
Planters' Oil Mill, Monroe, La.	4	27	41.31	*40.00*
Planters' Oil Mill, Monroe, La.	1	625	41.25	*38.75*
Planters' Oil Mill, Monroe, La.	4	22	42.81	*42.00*
	4	38	40.94	*42.00*
	3	237	38 59	*42.00*
	1	330	40.28	*42.00*
	1	497	42.00	*42.00*
	2	573	41.12	*42.00*
	3	630	43.41	*42.00*
Average	18		41.30	*42.00*
Port Gibson Oil Works, Port Gibson, Miss.	6	68	40.63	*38.00*
	3	184	42.62	*38.00*
	3	574	38.93	*38.00*
Average	12		40.72	*38.00*

SEED MEAL

per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
9.79	*10.00*	24.79	*27.37*	8.00	*9.00*	8.32	7.04
8.56	*10.00*	24.40	*27.37*	8.32	*9.00*	9.42	6.59
10.95	*10.00*	24.67	*27.37*	8.10	*9.00*	8.20	7.39
8.54	*10.00*	24.24	*27.37*	7.86	*9.00*	9.53	7.08
7.28	*10.00*	28.00	*27.37*	9.14	*9.00*	7.62	7.53
8.69	*10.00*	25.75	*27.37*	7.82	*9.00*	7.98	7.76
8.03	*10.00*	26.29	*27.37*	7.68	*9.00*	9.52	7.05
10.00	*10.00*	24.17	*27.37*	7.81	*9.00*	9.28	
8.98	*10.00*	25.29	*27.37*	8.09	*9.00*	8.73	.19
7.76	*7.75*	26.97	*28.00*	8.20	*8.40*	9.50	7.51
9.13	*8.20*	28.31	*25.00*	7.82	*9.50*	8.09	6.65
9.00	*8.20*	26.92	*25.00*	9.15	*9.50*	7.80	6.95
9.31	*8.00*	24.89	....	10.61	*10.00*	7.27	6.61
9.39	*7.75*	26.03	*28.00*	6.56	*8.40*	8.63	8.14
11.78	*8.00*	23.82	*15.00*	9.72	*10.00*	5.26	6.61
10.11	*8.00*	24.96	*15.00*	9.70	*10.00*	7.56	6.73
10.45	*8.00*	26.63	*15.00*	9.70	*10.00*	7.37	7.26
7.67	*8.00*	28.46	*15.00*	8.97	*10.00*	7.53	7.09
8.39	*8.00*	27.54	*15.00*	8.60	*10.00*	5.91	7.56
9.67	*8.00*	25.63	*15.00*	6.97	*10.00*	9.65	6.96
8.44	*8.00*	24.76	*15.00*	8.16	*10.00*	7.10	8.13
9.50	*8.00*	25.99	*15.00*	8.83	*10.00*	7.19	7.19
8.85	*8.00*	26.38	*22.00*	9.55	*11.00*	7.93	6.66
8.99	*8.00*	25.01	*22.00*	8.50	*11.00*	7.55	7.33
9.38	*8.00*	24.77	*22.00*	9.38	*11.00*	10.45	7.09
9.08	*8.00*	25.39	*22.00*	9.15	*11.00*	8.64	7.02

COTTON

Averaging 40 to 43

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Producers' Cotton Oil Co., **Yazoo City, Miss.**	1	132	40.68	*38.75*
Raccourci Cotton Oil Co., **Batchelor, La.**	2	134	40.12	*40.00*
Richmond Cotton Oil Co., **Memphis, Tenn.**	1	227	41.81	*38.75*
Ruston Oil Mill, **Ruston, La.**	1	25	43.06	*41.00*
	1	189	42.75	*41.00*
	1	281	41.93	*41.00*
	1	333	41.93	*41.00*
	2	384	41.25	*41.00*
Average	6		42.18	*41.00*
Union Oil Co., **Vidalia, La.**	1	564	42.18	*41.00*
Union Oil Co., **Monroe, La.**	9	36	41.06	*38.63*
	9	71	39.18	*38.63*
	6	90	40.56	*38.63*
	5	170	40.13	*38.63*
	4	197	41.50	*38.63*
	7	252	39.06	*38.63*
	2	294	43.37	*38.63*
	2	357	39.06	*38.63*
	2	401	42.56	*38.63*
	2	483	38.81	*38.63*
Average	48		40.53	*38.63*
Washington Cotton Oil Co., **Washington, La.**	1	53	40.44	*38.60*
	1	272	39.75	*38.60*
Average	2		40.09	*38.60*

SEED MEAL

per cent Protein,

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
10.71	*8.20*	26.21	*25.00*	8.72	*9.50*	6.65	7.03
9.00	*8.00*	27.21	*26.00*	9.32	*8.00*	6.85	7.50
9.48	*8.20*	26.51	*25.00*	6.85	*9.80*	7.67	7.68
7.90	*10.00*	23.54	*27.00*	7.93	*8.00*	5.79	11.78
7.65	*10.00*	27.25	*27.00*	7.52	*8.00*	7.75	7.08
11.50	*10.00*	25.22	*27.00*	5.47	*8.00*	9.16	6.72
11.13	*10.00*	25.96	*27.00*	6.30	*8.00*	8.12	6.56
10.80	*10.00*	25.26	*27.00*	6.79	*8.00*	9.02	6.88
9.80	*10.00*	25.45	*27.00*	6.80	*8.00*	7.97	7.80
7.80	*10.00*	25.48	*27.00*	7.85	*8.00*	9.53	7.16
8.41	*10.00*	26.39	*27.37*	8.54	*9.00*	8.83	6.77
9.80	*10.00*	27.89	*27.37*	8.72	*9.00*	7.72	6.69
10.17	*10.00*	25.15	*27.37*	9.13	*9.00*	7.44	7.55
8.38	*10.00*	27.11	*27.37*	9.51	*9.00*	8.06	6.81
8.43	*10.00*	26.87	*27.37*	8.48	*9.00*	7.85	6.87
9.94	*10.00*	23.72	*27.37*	9.82	*9.00*	10.48	6.98
8.75	*10.00*	24.33	*27.37*	6.09	*9.00*	10.48	6.98
7.55	*10.00*	26.89	*27.37*	10.46	*9.00*	9.29	6.75
8.37	*10.00*	25.62	*27.27*	8.88	*9.00*	8.23	6.34
7.54	*10.00*	27.36	*27.37*	10.97	*9.00*	8.33	6.99
8.74	*10.00*	26.13	*27.37*	9.06	*9.00*	8.67	6.87
14.45	*8.50*	22.09	*27.40*	9.10	*10.00*	7.62	6.30
11.70	*8.50*	23.56	*27.40*	9.23	*10.00*	9.17	6.59
13.08	*8.50*	22.83	*27.40*	9.17	*10.00*	8.39	6.44

COTTON

Averaging 38 to 40

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Alabama Cotton Oil Co., Montgomery, Ala.	1	130	40.12	38.75
	1	229	38.40	38.75
Average	2		39.26	38.75
Arcadia Cotton Oil Co., Arcadia, La.	1	169	39.12	40.00
Buckeye Cotton Oil Co., Selma, Ala.	4	67	39.00	38.75
Capital City Oil Mill, Baton Rouge, La.	1	273	41.12	40.00
	1	328	37.06	40.00
	1	378	36.74	40.00
	1	476	37.65	40.00
Average	4		38.14	40.00
Clay County Cotton Oil Co., West Point, Miss.	1	122	39.25	38.75
Clinton Cotton Oil Co., Clinton, La.	2	21	41.13	42.10
	2	124	35.78	42.10
Average	4		38.46	42.10
Columbia Cotton Oil & Manufacturing Co., New Orleans, La.	1	284	38.65	38.75
Columbia Cotton Oil & Manufacturing Co., New Orleans, La.	1	386	39.31	40.00
Concordia Cotton Oil Co., Vidalia, La.	6	15	40.18	40.00
	4	96	40.06	40.00
	1	232	37.80	40.00
	1	292	40.38	40.00
	1	329	39.35	40.00
Average	13		39.55	40.00

SEED MEAL

Per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
7.86	*8.20*	28.60	*25.00*	10.01	*9.50*	7.16	6.25
7.37	*8.20*	27.86	*25.00*	11.40	*9.50*	8.40	6.57
7.62	*8.20*	28.23	*25.00*	10.70	*9.50*	7.78	6.41
8.80	*6.59*	26.56	*27.00*	10.07	*8.00*	8.47	6.98
7.82	*8.20*	30.56	*25.00*	8.44	*9.50*	7.78	6.40
7.69	*7.00*	23.90	*26.00*	10.67	*8.00*	9.80	6.82
7.65	*7.00*	26.91	*26.00*	13.42	*8.00*	8.66	6.30
7.32	*7.00*	25.96	*26.00*	12.83	*8.00*	10.52	6.63
7.00	*7.00*	27.38	*26.00*	13.05	*8.00*	8.45	6.47
7.42	*7.00*	26.04	*26.00*	12.49	*8.00*	9.36	6.55
8.85	*8.20*	28.39	*25.00*	8.45	*9.50*	7.50	7.56
10.68	*5.10*	22.94	*16.09*	13.26	*10.00*	5.96	6.03
10.48	*5.10*	27.09	*16.09*	13.02	*10.00*	7.44	6.19
10.58	*5.10*	25.01	*6.09*	13.14	*10.00*	6.70	6.11
8.30	*7.75*	28.80	*28.00*	8.88	*8.40*	8.32	7.05
10.68	*8.00*	25.09	*26.00*	9.32	*8.00*	8.86	6.74
10.21	*6.59*	26.03	*27.00*	8.11	*8.00*	8.25	7.22
11.87	*6.59*	25.21	*27.00*	6.83	*8.00*	8.00	8.03
8.26	*6.59*	27.39	*27.00*	10.79	*8.00*	8.40	7.36
7.15	*6.59*	25.66	*27.00*	8.36	*8.00*	11.17	7.28
7.74	*6.59*	27.96	*27.00*	9.81	*8.00*	8.13	7.01
9.05	*6.59*	26.45	*27.00*	8.78	*8.00*	8.79	7.38

COTTON

Averaging 38 to 40

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
De Soto Cotton Oil Co., **Mansfield, La.**	3	88	36.18	*38.75*
	3	282	37.84	*38.75*
	2	355	41.06	*38.75*
Average	8		38.36	*38.75*
Humphrey-Godwin Co., **Memphis, Tenn.** Dixie Brand	1	145	39.31	*41.00*
Independent Cotton Oil Co., **Columbus, Miss.**	1	557	38.81	*38.75*
J. T. Wells, **Memphis, Tenn.** Star Brand	2	260	41.49	*43.00*
	2	374	39.78	*43.00*
	1	406	40.45	*43.00*
	8	631	32.91	*43.00*
Average	13		38.66	*43.00*
Macon Cotton Oil Co., **Tuskegee, Ala.**	2	256	39.75	*38.75*
	1	306	39.68	*38.75*
Average	3		39.71	*38.75*
Madison Cotton Oil Co., **Tallulah, La.**	1	190	38.34	*40.00*
	1	392	40.31	*40.00*
Average	2		39.32	*40.00*
Natchitoches Cotton Oil Co., **Natchitoches, La.**	1	121	36.18	*33.00*
	1	404	40.43	*33.00*
Average	2		38.30	*33.00*
Producers' Cotton Oil Co., **Yazoo City, Miss.**	3	611	39.38	*38.15*

SEED MEAL

per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
8.76	*8.20*	30.08	*25.00*	8.68	*9.50*	8.77	7.53
8.34	*8.20*	28.66	*25.00*	8.67	*9.50*	9.10	7.39
8.26	*8.20*	27.47	*25.00*	6.82	*9.50*	8.70	7.69
8.45	*8.20*	28.74	*25.00*	8.06	*9.50*	8.85	7.54
8.87	*8.50*	27.38	*23.00*	8.47	*10.00*	8.35	7.62
8.10	*7.75*	27.64	*28.00*	9.02	*8.40*	9.65	6.78
8.61	*9.00*	27.76	*20.00*	6.47	*10.50*	7.61	8.06
10.39	*9.00*	25.43	*20.00*	6.75	*10.50*	9.87	7.78
9.29	*9.00*	26.99	*20.00*	7.76	*10.50*	8.10	7.41
6.66	*9.00*	30.82	*20.00*	15.09	*10.50*	8.22	6.30
8.74	*9.00*	27.75	*20.00*	9.02	*10.50*	8.45	7.38
7.52	*7.75*	27.66	*28.00*	10.36	*8.40*	8.53	6.18
7.02	*7.75*	28.37	*28.00*	9.54	*8.40*	9.51	5.88
7.27	*7.75*	28.02	*28.00*	9.95	*8.40*	9.02	6.03
13.00	*8.00*	24.98	*26.00*	8.57	*8.00*	7.63	7.48
8.37	*8.00*	25.35	*26.00*	8.89	*8.00*	9.57	7.51
10.69	*8.00*	25.16	*26.00*	8.73	*8.00*	8.60	7.50
13.45	*12.00*	25.68	*18.00*	9.75	*12.00*	8.10	6.84
6.54	*12.00*	28.71	*18.00*	9.13	*12.00*	7.77	7.42
10.00	*12.00*	27.19	*18.00*	9.44	*12.00*	7.94	7.13
9.17	*8.40*	25.66	*26.76*	8.98	*10.54*	9.59	7.22

COTTON

Averaging 38 to 40

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Red River Cotton Oil Co., **Alexandria, La.**	2 3	107 211	36.87 40.56	*29.25* *29.25*
Average	5		38.71	*29.25*
Sonia Cotton Oil Co., **Alexandria, La.**	1	234	39.56	*43.30*
Tensas Cotton Oil Co., **St. Joseph, La.**	1 1	253 372	36.75 42.00	*40.00* *40.00*
Average	2		39.38	*40.00*
Union Oil Co., **Vidalia, La.**	2	100	38.93	*40.00*

SEED MEAL

per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
9.49	*7.25*	28.03	*35.26*	11.39	*22.00*	7.52	6.70
9.76	*7.25*	25.26	*35.26*	8.43	*22.00*	9.05	6.94
9.63	*7.25*	26.64	*35.26*	9.91	*22.00*	8.29	6.82
7.27	*9.60*	26.85	*18.90*	10.79	*8.70*	8.40	7.13
13.50	*8.00*	25.16	*26.00*	9.28	*8.00*	8.21	7.10
10.12	*8.00*	23.55	*26.00*	7.15	*8.00*	9.37	7.81
11.81	*8.00*	24.35	*26.00*	8.21	*8.00*	8.79	7.46
9.84	*6.59*	26.99	*27.00*	9.65	*8.00*	7.47	7.12

COTTON

Averaging less than

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Boyce Cotton Oil Co., **Boyce, La.**	2	136	35.46	*40.00*
Caddo Fertilizer Co., **Shreveport, La.**	6	62	28.25	*28.33*
	3	125	21.88	*28.33*
	6	206	22.21	*28.33*
Average	15		24.11	*28.33*
Caddo Fertilizer Co., **Shreveport, La.**	6	210	22.86	*25.80*
	9	356	21.56	*25.80*
	1	407	24.43	*25.80*
Average	16		22.95	*25.80*
Caddo Fertilizer Co., **Shreveport, La.**	1	408	24.68	*32.50*
	1	487	25.00	*32.50*
Average	2		24.84	*32.50*
Clinton Cotton Oil Co., **Clinton, La.**	3	99	34.68	*38.00*
	5	238	34.99	*38.00*
	1	405	37.28	*38.00*
	1	488	35.46	*38.00*
Average	10		35.60	*38.00*
Columbia Cotton Oil and Manufacturing Co., **New Orleans, La.**	1	131	36.43	*30.00*
New Roads Cotton Oil Co., **New Roads, La.**	2	144	36.72	*40.00*
	1	230	38.84	*40.00*
	1	332	37.62	*40.00*
	1	489	38.43	*40.00*
Average	5		37.90	*40.00*
Red River Cotton Oil Co., **Alexandria, La.**	1	156	36.87	*33.00*

SEED MEAL

38 per cent. Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
14.77	*8.00*	26.31	*26.00*	10.18	*8.00*	6.74	6.54
13.58	*9.00*	26.57	*29.50*	17.13	*17.70*	9.19	5.28
9.99	*9.00*	31.41	*29.50*	25.26	*17.70*	6.83	4.63
8.76	*9.00*	30.45	*29.50*	23.94	*17.70*	9.74	4.90
10.78	*9.00*	29.48	*29.50*	22.11	*17.70*	8.59	4.93
7.86	*7.00*	30.46	*29.00*	23.42	*15.00*	10.03	5.37
5.88	*7.00*	32.92	*29.00*	25.20	*15.00*	9.31	5.13
10.05	*7.00*	28.02	*29.00*	25.19	*15.00*	7.46	4.85
7.93	*7.00*	30.47	*29.00*	24.60	*15.00*	8.93	5.12
10.24	*7.00*	26.38	*29.00*	26.10	*15.00*	7.65	4.95
7.54	*7.00*	31.34	*29.00*	22.97	*15.00*	7.96	5.19
8.89	*7.00*	28.86	*29.00*	24.54	*15.00*	7.80	5.07
9.58	*10.00*	27.57	*21.00*	15.14	*9.00*	7.22	5.81
6.34	*10.00*	28.79	*21.00*	15.81	*9.00*	7.88	6.19
6.29	*10.00*	26.81	*21.00*	15.05	*9.00*	8.48	6.09
7.09	*10.00*	29.03	*21.00*	15.43	*9.00*	7.16	5.83
7.32	*10.00*	28.05	*21.00*	15.36	*9.00*	7.69	5.98
9.69	*8.00*	28.01	*25.00*	11.73	*10.00*	7.09	7.05
13.40	*8.00*	25.27	*26.00*	9.44	*8.00*	8.27	6.90
6.38	*8.00*	27.73	*26.00*	11.73	*8.00*	7.98	7.34
7.43	*8.00*	28.07	*26.00*	12.66	*8.00*	7.20	7.02
6.91	*8 00*	26.97	*26.00*	12.58	*8.00*	8.11	7.00
8.53	*8.00*	27 01	*26.00*	11.60	*8.00*	7.89	7.07
10.29	*12.00*	27.32	*18.00*	11.77	*12.00*	7.05	6.70

COTTON

Averaging less than

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Southern Cotton Oil Co.,	1	24	22.13	*20.50*
New Orleans, La.	1	155	22.19	*20.50*
Average	2		22.16	*20.50*
Southern Cotton Oil Co., **New Orleans, La.** Durham Brand.	1	614	23.13	*23.00*
Tennessee Fibre Co.,	2	29	22.38	*22.00*
Memphis, Tenn.	2	139	18.81	*22.00*
Cremo Brand.	4	239	23.81	*22.00*
	1	299	22.93	*22.00*
	3	359	22.18	*22.00*
	1	370	19.71	*22.00*
	1	498	22.62	*22.00*
	1	613	21.88	*22.00*
Average	15		21.79	*22.00*
Tennessee Fibre Co.,	1	140	19.97	*24.00*
Memphis, Tenn.	1	225	19.56	*24.00*
Perfection Brand. Average	2		19.77	*24.00*
Union Oil Mill, **Bunkie, La.**	2	103	36.63	*39.00*

SEED MEAL

38 per cent Protein.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
5.02	*4.50*	37.64	*38.00*	22.79	*20.50*	7.56	4.86
5.35	*4.50*	36.92	*38.00*	21.71	*20.50*	8.77	5.06
5.18	*4.50*	37.28	*38.00*	22.25	*20.50*	8.17	4.96
5.44	*4.50*	34.75	*35.00*	20.70	*8.00*	10.93	5.05
5.52	*5.00*	36.36	*38.00*	21.88	*28.00*	8.75	5.11
4.73	*5.00*	37.96	*38.00*	25.27	*28.00*	8.55	4.68
4.76	*5.00*	36.14	*38.00*	21.84	*28.00*	8.00	5.45
4.42	*5.00*	35.12	*38.00*	20.90	*28.00*	11.45	5.18
4.44	*5.00*	37.79	*38.00*	20.65	*28.00*	9.85	5.09
5.04	*5.00*	37.24	*38.00*	23.60	*28.00*	9.72	4.69
5.13	*5.00*	36.00	*38.00*	23.02	*28.00*	7.90	5.33
5.09	*5.00*	35.65	*38.00*	22.67	*28.00*	9.64	5.07
4.89	*5.00*	36.54	*38.00*	22.47	*28.00*	9.23	5.08
4.78	*5.00*	38.04	*38.00*	23.95	*28.00*	8.25	5.01
4.43	*5.00*	36.94	*38.00*	25.18	*28.00*	9.17	4.72
4.60	*5.00*	37.49	*38.00*	24.57	*28.00*	8.71	4.86
10.64	*9.00*	25.74	*27.00*	12.87	*8.00*	7.48	6.64

RICE

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
American Rice Milling Co., Crowley, La.	2	46	6.32	*7.50*
	4	95	6.16	*7.50*
	1	178	6.91	*7.50*
	1	240	6.81	*7.50*
Average	8		6.54	*7.50*
Crowley Rice Milling Co., Crowley, La.	5	109	12.15	*13.94*
	4	221	11.74	*13.94*
Average	9		11.95	*13.94*
David & Crescent Rice Milling Co., New Orleans, La.	1	158	9.59	*11.30*
Donaldsonville Rice Milling Co., Donaldsonville, La.	4	43	12.00	*10.95*
	9	63	11.25	*10.95*
	4	186	11.90	*10.95*
	7	286	11.75	*10.95*
	1	314	13.00	*10.95*
	2	360	12.37	*10.95*
	1	424	12.31	*10.95*
Average	28		12.08	*10.95*
Donaldsonville Rice Milling Co., Donaldsonville, La.	1	56	12.62	*9.00*
	1	192	11.69	*9.00*
Average	2		12.16	*9.00*
B. F. Glover, New Orleans, La.	1	509	6.21	*8.08*
Haspel & Davis, New Orleans, La.	3	18	11.31	*8.84*
	5	42	10.25	*8.84*
Average	8		10.78	*8.84*
Jeannerette Rice Milling Co., Jeannerette, La.	4	66	10.63	*11.37*
	5	161	11.87	*11.37*
Average	9		11.25	*11.37*

BRAN

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.86	*5.32*	35.26	*40.00*	28.33	*25.00*	9.83	15.40
5.10	*5.32*	38.56	*40.00*	26.73	*25.00*	7.70	15.78
4.46	*5.32*	39.96	*40.00*	25.01	*25.00*	9.02	14.64
4.06	*5.32*	40.37	*40.00*	24.60	*25.00*	8.67	15.49
4.62	*5.32*	38.54	*40.00*	26.17	*25.00*	8.80	15.33
12.13	*19.30*	41.25	*35.26*	13.75	*12.20*	7.74	12.98
10.11	*19.30*	41.09	*35.26*	15.03	*12.20*	10.85	11.18
11.12	*19.30*	41.16	*35.26*	14.39	*12.20*	9.30	12.08
8.65	*12.26*	44.94	*43.64*	16.58	*12.82*	8.41	11.83
11.74	*10.75*	40.82	*35.74*	15.42	*21.57*	9.18	10.84
12.50	*10.75*	40.37	*35.74*	15.84	*21.57*	9.78	10.26
12.22	*10.75*	40.59	*35.74*	16.55	*21.57*	7.77	10.97
11.72	*10.75*	42.22	*35.74*	14.00	*21.57*	9.68	10.63
12.80	*10.75*	40.65	*35.74*	13.50	*21.57*	9.50	10.55
10.23	*10.75*	44.41	*35.74*	13.93	*21.57*	9.18	9.88
10.75	*10.75*	41.23	*35.74*	15.03	*21.57*	8.65	12.03
11.71	*10.75*	41 47	*35.74*	14.90	*21.57*	9.10	10.74
11.36	*10.42*	41.13	*33.72*	15.15	*21.71*	9.09	10.65
11.58	*10.42*	40.86	*33.72*	15.69	*21.71*	8.38	11.80
11.47	*10.42*	40.99	*33.72*	15.42	*21.71*	8.73	11.23
2.77	*8.65*	37.54	*37.38*	29.11	*23.81*	7.78	16.59
11.02	*13.10*	44.99	*41.43*	13.83	*16.11*	9.23	9.62
10.32	*13.10*	44.99	*41.43*	14.57	*16.11*	9.48	10.39
10.67	*13.10*	44.99	*41.43*	14.20	*16.11*	9.36	10.00
9.60	*8.50*	50.49	*48.13*	9.50	*12.50*	9.49	10.29
9.90	*8.50*	47.75	*48.13*	12.43	*12.50*	9.55	8.50
9.75	*8.50*	49.12	*48.13*	10.97	*12.50*	9.52	9.39

RICE

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Levy Rice Milling Co., **New Orleans, La.**	6	114	7.65	*9.00*
Orleans Rice Milling Co., **New Orleans, La.**	4	16	5.56	*5.46*
	2	47	5.66	*5.46*
	3	93	4.33	*5.46*
	2	175	6.00	*5.46*
	1	266	5.27	*5.46*
	3	317	6.56	*5.46*
	1	377	5.34	*5.46*
	2	453	6.43	*5.46*
	1	499	5.62	*5.46*
	1	558	5.43	*5.46*
	2	635	6.44	*5.46*
Average	22		5.70	*5.46*
New Basin Rice Milling Co., **New Orleans, La.**	4	606	6.49	*8.08*
Planters' Rice Milling Co., **Abbeville, La.**	5	142	12.58	*10.00*
	1	195	13.00	*10.00*
	2	510	14.24	*10.00*
	1	553	13.46	*10.00*
Average	9		13.32	*10.00*
Rayne Rice Milling Co., **Rayne, La.**	6	92	5.68	*7.00*
	7	188	6.56	*7.00*
	6	220	6.82	*7.00*
Average	19		6.35	*7.00*
Siewerd Rice Milling Co., **New Orleans, La.**	2	48	9.81	*11.30*
	1	177	11.31	*11.30*
	1	484	10.02	*11.30*
	1	560	12.50	*11.30*
Average	5		10.91	*11.30*

BRAN

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
6.80	*8.45*	37.27	*44.00*	25.45	*18.00*	8.20	14.63
3.89	*3.23*	34.99	*36.61*	30.24	*28.87*	8.47	16.85
3.44	*3.23*	34.38	*36.61*	30.74	*28.87*	9.29	16.49
3.81	*3.23*	35.92	*36.61*	31.18	*28.87*	8.29	16.47
3.55	*3.23*	34.79	*36.61*	30.72	*28.87*	9.18	15.76
3.44	*3.23*	46.84	*36.61*	18.74	*28.87*	7.55	18.16
4.50	*3.23*	34.57	*36.61*	28.37	*28.87*	8.77	17.23
3.47	*3.23*	32.92	*36.61*	32.35	*28.87*	9.28	16.64
3.26	*3.23*	34.59	*36.61*	30.54	*28.87*	7.51	17.67
1.70	*3.23*	41.23	*36.61*	27.76	*28.87*	7.60	16.09
2.63	*3.23*	31.87	*36.61*	31.23	*28.87*	8.83	20.01
2.96	*3.23*	35.05	*36.61*	30.68	*28.87*	7.22	17.65
3.33	*3.23*	36.11	*36.61*	29.32	*28.87*	8.36	17.18
3.09	*8.65*	36.41	*37.38*	28.43	*23.81*	8.70	16.88
10.80	*11.00*	48.74	*42.00*	10.35	*15.00*	8.02	9.51
12.13	*11.00*	47.20	*42.00*	10.05	*15.00*	9.08	8.54
12.43	*11.00*	45.21	*42.00*	9.62	*15.00*	9.60	8.90
11.44	*11.00*	45.69	*42.00*	9.37	*15.00*	11.08	8.96
11.70	*11.00*	46.71	*42.00*	9.85	*15.00*	9.44	8.98
3.70	*4.50*	39.77	*37.25*	26.65	*27.25*	8.32	15.88
3.61	*4.50*	39.98	*37.25*	25.93	*27.25*	8.16	15.76
4.28	*4.50*	38.21	*37.25*	25.21	*27.25*	10.15	15.33
3.86	*4.50*	39.32	*37.25*	25.93	*27.25*	8.88	15.66
8.70	*12.26*	40.75	*43.64*	18.93	*12.82*	9.50	12.31
11.27	*12.26*	39.71	*43.64*	17.07	*12.82*	8.82	11.82
8.63	*12.26*	44.22	*43.64*	16.45	*12.82*	8.24	12.44
10.80	*12.26*	46.15	*43.64*	11.71	*12.82*	9.54	9.30
9.85	*12.26*	42.70	*43.64*	16.04	*12.82*	9.03	11.47

RICE

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Socola Rice Milling Co., **New Orleans, La.** (A. S.) Brand.	7	44	10.97	*11.37*
	2	185	11.38	*11.37*
Average	9		11.18	*11.37*
Socola Rice Milling Co., **New Orleans, La.** (M) Brand	2	50	6.74	*6.06*
	7	83	6.06	*6.06*
	2	196	7.18	*6.06*
	3	265	7.15	*6.06*
	3	316	8.81	*6.06*
	1	477	7.24	*6.06*
	2	612	8.69	*6.06*
Average	20		7.41	*6.06*
Southern Rice Milling Co., **New Orleans, La.**	2	49	10.81	*9.62*
	2	138	9.63	*9.62*
	1	338	11.10	*9.62*
Average	5		10.51	*9.62*
Southern Rice Milling Co., **New Orleans, La.**	1	368	11.18	*10.45*
	1	460	10.34	*10.45*
Average	2		10.76	*10.45*
Wall Rice Milling Co., **Lake Charles, La.** (Mixed Rice Bran.)	5	108	6.69	*6.43*
	1	242	5.15	*6.43*
	4	300	6.28	*6.43*
Average	10		6.04	*6.43*

BRAN

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
11.03	*12.50*	39.00	*42.27*	17.13	*14.40*	10.05	11.82
9.97	*12.50*	40.75	*42.27*	16.63	*14.40*	8.50	12.77
10.50	*12.50*	39.87	*42.27*	16.88	*14.40*	9.28	12.29
6.18	*5.75*	33.54	*33.09*	27.98	*29.12*	9.52	16.04
7.19	*5.75*	37.78	*33.09*	25.33	*29.12*	8.40	15.24
5.89	*5.75*	35.66	*33.09*	27.10	*29.12*	8.42	15.75
6.00	*5.75*	35.40	*33.09*	28.88	*29.12*	8.13	14.44
6.50	*5.75*	38.91	*33.09*	23.00	*29.12*	9.10	13.68
5.17	*5.75*	35.81	*33.09*	26.90	*29.12*	8.20	16.68
6.95	*5.75*	39.07	*33.09*	22.13	*29.12*	9.05	14.11
6.27	*5.75*	36.60	*33.09*	25.90	*29.12*	8.69	15.13
10.95	*10.00*	41.71	*38.72*	16.18	*19.50*	9.55	10.80
8.65	*10.00*	41.97	*38.72*	19.27	*19.50*	7.98	12.50
12.09	*10.00*	41.11	*38.72*	15.78	*19.50*	8.42	11.50
10.56	*10.00*	41.60	*38.72*	17.08	*19.50*	8.65	11.60
11.27	*9.50*	40.18	*39.39*	15.72	*18.68*	9.97	11.68
9.07	*9.50*	49.08	*39.39*	12.69	*18.68*	8.73	10.09
10.17	*9.50*	44.63	*39.39*	14.21	*18.68*	9.35	10.88
4.97	*2.60*	36.52	*34.65*	28.52	*29.30*	8.78	14.52
4.19	*2.60*	37.12	*34.65*	29.00	*29.30*	9.45	15.09
4.25	*2.60*	33.75	*34.65*	30.13	*29.30*	10.02	15.57
4.47	*2.60*	35.80	*34.65*	29.22	*29.30*	9.41	15.06

MOLASSES

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
American Milling Company,	1	339	18.25	*16.50*
Philadelphia, Pa.	2	480	17.00	*16.50*
Sucrene Dairy Feed.	1	565	17.43	*16.50*
	7	642	16.88	*16.50*
Average	11		17.39	*16.50*
American Milling Company,	3	471	15.12	*13.50*
Philadelphia, Pa.	1	567	14.87	*13.50*
Sucrene Horse Feed.	3	640	14.28	*13.50*
Average	7		14.76	*13.50*
Atlas Feed Company,	5	20	8.66	*9.00*
New Orleans, La.	19	73	8.69	*9.00*
Royal Stock Feed.	8	115	9.40	*9.00*
	11	173	8.90	*9.00*
	7	247	9.00	*9.00*
	15	303	8.12	*9.00*
	5	367	7.50	*9.00*
	7	472	11.65	*9.00*
	3	585	7.59	*9.00*
	1	148	7.93	*9.00*
	4	641	9.84	*9.00*
Average	85		8.84	*9.00*
Atlas Feed Company,	5	72	6.75	*6.00*
New Orleans, La.	3	200	7.44	*6.00*
Sugared Feed.	1	321	5.99	*6.00*
	1	464	6.62	*6.00*
	1	605	5.78	*6.00*
Average	11		6.52	*6.00*
Atlas Feed Company,	4	87	18.69	*15.00*
New Orleans, La.	1	271	14.71	*15.00*
Union Feed.				
Average	5		16.70	*15.00*

FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.26	*3.50*	47.47	*48.54*	9.12	*11.77*	13.64	8.26
3.29	*3.50*	51.61	*48.54*	8.89	*11.77*	11.38	7.83
3.51	*3.50*	44.63	*48.54*	9.09	*11.77*	17.12	8.22
3.40	*3.50*	50.42	*48.54*	9.60	*11.77*	11.33	8.37
3.37	*3.50*	48.53	*48.54*	9.17	*11.77*	13.37	8.17
2.37	*3.50*	53.61	*53.31*	8.93	*11.01*	12.39	7.58
2.12	*3.50*	51.66	*53.31*	9.42	*11.01*	14.55	7.38
2.14	*3.50*	56.53	*53.31*	9.80	*11.01*	10.35	6.90
2.21	*3.50*	53.93	*53.31*	9.38	*11.01*	12.43	7.29
3.67	*1.00*	55.30	*48.00*	12.57	*10.00*	10.48	9.32
3.71	*1.00*	55.20	*48.00*	11.87	*10.00*	12.20	8.33
5.10	*1.00*	54.43	*48.00*	12.03	*10.00*	9.82	9.22
2.25	*1.00*	57.18	*48.00*	11.64	*10.00*	11.10	8.93
2.65	*1.00*	53.44	*48.00*	13.74	*10.00*	11.32	9.85
1.89	*1.00*	50.55	*48.00*	13.18	*10.00*	16.35	9.91
1.72	*1.00*	53.23	*48.00*	13.99	*10.00*	14.75	8.81
2.73	*1.00*	53.24	*48.00*	12.44	*10.00*	12.24	7.70
1.85	*1.00*	51.16	*48.00*	12.90	*10.00*	17.63	8.87
2.47	*1.00*	55.37	*48.00*	12.86	*10.00*	11.75	9.62
2.76	*1.00*	53.92	*48.00*	12.99	*10.00*	11.92	8.57
2.80	*1.00*	53.91	*48.00*	12.75	*10.00*	12.69	9.01
2.88	*.50*	52.23	*50.00*	15.43	*10.00*	12.16	10.55
1.45	*.50*	54.99	*50.00*	12.07	*10.00*	13.82	10.23
2.27	*.50*	50.85	*50.00*	17.58	*10.00*	11.63	11.68
1.08	*.50*	54.10	*50.00*	14.88	*10.00*	14.02	9.30
1.28	*.50*	51.05	*50.00*	14.89	*10.00*	15.76	11.24
1.79	*50.00*	52.64	*50.00*	14.97	*10.00*	13.48	10.60
6.75	*3.00*	43.13	*40.00*	12.26	*10.00*	10.48	8.69
5.32	*3.00*	45.62	*40.00*	14.01	*10.00*	10.03	10.31
6.04	*3.00*	44.37	*40.00*	13.14	*10.00*	10.25	9.50

MOLASSES

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Atlas Feed Company,	5	82	9.88	*11.00*
New Orleans, La.	3	223	7.87	*11.00*
Ox Feed.	1	320	9.81	*11.00*
Average	9		9.19	*11.00*
Lawrence Feed Company,	4	85	15.75	*17.50*
Crowley, La.	2	298	13.43	*17.50*
Momylk.	9	366	9.47	*17.50*
	1	473	8.72	*17.50*
	3	512	10.99	*17.50*
	1	568	9.15	*17.50*
Average	20		11.25	*17.50*
Lawrence Feed Company,	9	35	12.38	*12.37*
Crowley, La.	14	65	12.27	*12.37*
Nutriline.	8	110	11.56	*12.37*
	12	164	11.87	*12.37*
	25	214	10.68	*12.37*
	22	301	10.96	*12.37*
	23	365	10.97	*12.37*
	8	409	11.81	*12.37*
	15	470	11.18	*12.37*
	28	495	9.68	*12.37*
	14	578	10.59	*12.37*
	4	638	11.22	*12.37*
Average	182		11.26	*12.37*

FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
5.18	*2.00*	51.89	*50.00*	12.71	*6.00*	11.51	8.83
1.98	*2.00*	55.00	*50.00*	11.34	*6.00*	14.72	9.09
2.85	*2.00*	56.03	*50.00*	11.18	*6.00*	12.05	8.08
3.34	*2.00*	54.30	*50.00*	11.74	*6.00*	12.76	8.67
6.29	*3.25*	43.76	*50.00*	12.71	*9.40*	11 40	10.09
2.74	*3.25*	48.86	*50.00*	12.18	*9.40*	15.84	6.95
1.69	*3.25*	54.57	*50.00*	11.13	*9.40*	15.79	7.35
2.65	*3.25*	55.45	*50.00*	10.16	*9.40*	14.97	8.05
3.15	*3.25*	49.23	*50.00*	14.26	*9.40*	13.92	8.45
1.26	*3.25*	50.60	*50.00*	14.86	*9.40*	16.60	7.53
2.97	*3.25*	50.40	*50.00*	12.55	*9.40*	14.76	8.07
2.18	*2.11*	54.09	*60.57*	10.95	*8.95*	11.37	9.03
3.35	*2.11*	54.84	*60.57*	9.35	*8.95*	12.01	8.18
4.08	*2.11*	57.50	*60.57*	9.21	*8.95*	9.62	8.03
3.45	*2.11*	58.00	*60.57*	8.44	*8.95*	10.64	7.60
4.34	*2.11*	56.65	*60.57*	8.12	*8.95*	12.92	7.29
4.37	*2.11*	55.62	*60.57*	9.31	*8.95*	12.40	7.34
3.14	*2.11*	57.06	*60.57*	10.06	*8.95*	11.72	7.05
2.77	*2.11*	57.15	*60.57*	10.08	*8.95*	10.20	7.99
3.10	*2.11*	57.31	*60.57*	10.15	*8.95*	10.28	7.98
3.95	*2.11*	57.59	*60.57*	11.16	*8.95*	8.47	9.15
2.33	*2.11*	54.61	*60.57*	11.55	*8.95*	12.02	8.90
1.56	*2.11*	56.10	*60.57*	12.29	*8.95*	9.57	9.26
3.21	*2.11*	56.39	*60.57*	10.05	*8.95*	10.94	8.15

CORN AND

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
American Cereal Company, **Chicago, Ill.** Banner Feed	2	241	9.00	*8.00*
	4	344	9.18	*8.00*
	2	481	9.06	*8.00*
	4	523	8.37	*8.00*
	11	583	9.25	*8.00*
Average	23		8.96	*8.00*
American Cereal Company, **Chicago, Ill.** Banner Feed	1	462	8.65	*9.00*
American Cereal Company, **Chicago, Ill.**	6	89	6.69	*9.00*
American Cereal Company, **Chicago, Ill.** Victor C. and O. Feed	7	245	7.68	*7.50*
	5	302	8.12	*7.50*
	6	347	8.18	*7.50*
	1	419	8.18	*7.50*
	6	451	8.75	*7.50*
	5	522	8.06	*7.50*
Average	30		8.16	*7.50*
Atchinson Live Stock Co., **Atchinson, Kan.**	2	94	5.40	*6.00*
	1	269	7.68	*6.00*
	1	191	7.44	*6.00*
	1	561	9 68	*6.00*
Average	5		7.55	*6.00*
Corno Mills Company, **East St. Louis, Ill.** Diamond C	5	267	7.87	*10.00*
	3	346	7.32	*10.00*
	1	337	7.96	*10.00*
	4	387	8.12	*10.00*
	1	418	7.84	*10.00*
	3	461	7.90	*10.00*
	3	518	7.53	*10.00*
	2	633	7.41	*10.00*
Average	22		7.74	*10.00*
Cunningham Commission Company **Little Rock, Ark.**	1	562	10.62	*13.00*

OAT FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.43	*3.50*	63.02	*62.00*	10.86	*10.00*	10.38	3.31
3.55	*3.50*	64.72	*62.00*	10.63	*10.00*	8.71	3.21
3.47	*3.50*	66.35	*62.00*	8.63	*10.00*	9.62	2.87
3.53	*3.50*	64.77	*62.00*	10.93	*10.00*	9.37	3.03
3.12	*3.50*	64.84	*62.00*	9.28	*10.00*	10.12	3.39
3.42	*3.50*	64.74	*62.00*	10.07	*10.00*	9.64	3.17
3.31	*4.50*	4.71	*67.10*	10.59	*8.50*	9 31	3.43
3.05	*4.00*	62.31	*62.00*	13.81	*11.00*	10.23	3.91
2.95	*3.00*	63.10	*62.00*	12.39	*12.00*	10.21	3.67
3.15	*3.00*	62.30	*62.00*	10.98	*12.00*	11.93	3.52
3.39	*3.00*	61.18	*62.00*	12.07	*12.00*	11.63	3.55
2.33	*3.00*	67.72	*62.00*	9.86	*12.00*	8.87	3.04
3.32	*3.00*	64.51	*62.00*	11.11	*12.00*	8.84	3.47
3.10	*3.00*	64.21	*62.00*	11.56	*12.00*	9.67	3.40
3.04	*3.00*	63.84	*62.00*	11.33	*12.00*	10.19	3.44
2.72	*3.00*	55.45	*60.00*	22.84	*20.00*	8.32	5.27
2.70	*3.00*	59.63	*60.00*	16.42	*20.00*	9.57	4.00
4.64	*3.00*	57.05	*60.00*	16.95	*20.00*	9.74	4.18
3.25	*3.00*	62.05	*60.00*	10.12	*20.00*	10.51	4.39
3.33	*3.00*	58.54	*60.00*	16.58	*20.00*	9.54	4.46
3.62	*4.60*	60.41	*61.20*	14.72	*11.40*	9.04	4.34
3.40	*4.60*	57.31	*61.20*	15.65	*11.40*	10.51	5.81
3.54	*4.60*	60.81	*61.20*	13.09	*11.40*	10.54	4.06
3.77	*4.60*	56.35	*61.20*	16.41	*11.40*	10.05	5.30
3.05	*4.60*	60.89	*61.20*	15.08	*11.40*	8.55	4.59
3.47	*4.60*	61.22	*61.20*	14.56	*11.40*	8.55	4.30
3.81	*4.60*	58.75	*61.20*	15.18	*11.40*	9.41	5.32
1.76	*4.60*	62.17	*61.20*	16.18	*11.40*	8.06	4.42
3.30	*4.60*	59.75	*61.20*	15.10	*11.40*	9.34	4.77
3.38	*4.00*	51.14	*52.00*	13.40	*15.00*	11.04	10.42

CORN AND

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Great Western Cereal Company,	1	17	8.38	*9.00*
Chicago, Ill.	1	193	8.59	*9.00*
Excelsior.	2	349	8.43	*9.00*
	1	550	8.27	*9.00*
	1	616	10.13	*9.00*
Average	6		8.76	*9.00*
Illinois Feed Mills,	1	506	7.37	*7.20*
St. Louis. Mo.				
Peck's Mill Feed.				
Ralston Purina Company,	1	268	11.75	*11.20*
St. Louis, Mo.	1	335	11.56	*11.20*
	1	389	10.96	*11.20*
Creola.	2	467	10.18	*11.20*
	1	496	9.27	*11.20*
Average	6		10.74	*11.20*
Ralston Purina Company,	2	146	6.81	*7.40*
St. Louis, Mo.	2	218	6.06	*7.40*
Peerless.	2	296	8.69	*7.40*
	7	341	7.21	*7.40*
	1	390	10.93	*7.40*
	4	478	8.37	*7.40*
	4	515	7.43	*7.40*
	3	576	7.50	*7.40*
	3	622	7.53	*7.40*
Average	28		7.84	*7.40*

OAT FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
5.21	*4.20*	57.56	*60.00*	15.39	*10.00*	8.68	4.78
5.12	*4.20*	60.20	*60.00*	11.83	*10.00*	9.36	4.90
4.97	*4.20*	59.51	*60.00*	12.14	*10.00*	9.67	5.28
5.77	*4.20*	59.37	*60.00*	9.71	*10.00*	10.63	6.25
1.45	*4.20*	62.55	*60.00*	10.03	*10.00*	11.36	4.48
4.50	*4.20*	59.84	*60.00*	11.82	*10.00*	9.94	5.14
2.83	*3.80*	59.19	*58.80*	15.52	*15.00*	8.93	6.16
3.20	*4.30*	48.63	*58.50*	19.83	*12.60*	7.79	8.80
3.66	*4.30*	51.27	*58.50*	18.32	*12.60*	7.71	7.48
3.95	*4.30*	49.76	*58.50*	18.47	*12.60*	9.87	6 99
3.17	*4.30*	52.40	*58.50*	17.87	*12.60*	7.48	8.90
3.95	*4.30*	55.42	*58.50*	17.80	*12.60*	7.18	6.38
3.59	*4.30*	51.49	*58.50*	18.46	*12.60*	8.01	7.71
3.56	*3.80*	53.99	*59.20*	17.22	*14.70*	9.73	8.68
3.14	*3.80*	55.14	*59.20*	16.83	*14.70*	11.19	7.64
3.81	*3.80*	53.66	*59.20*	15.71	*14.70*	10.95	7.18
3.02	*3.80*	56.67	*59.20*	16.90	*14.70*	8.34	7.86
2.65	*3.80*	50.84	*59.20*	17.94	*14.70*	10.65	6.99
3.20	*3.80*	59.07	*59.20*	14.45	*14.70*	9.33	5.58
3.11	*3.80*	59.19	*59.20*	14.64	*14.70*	9.38	6.25
2.50	*3.80*	57.61	*59.20*	15.12	*14.70*	10.32	6.95
1.55	*3.80*	58.13	*59.20*	15.64	*14.70*	10.32	6.83
2.95	*3.80*	56.03	*59.20*	16.05	*14.70*	10.02	7.11

CORN AND

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Ralston Purina Company,	8	40	8.19	*10.30*
St. Louis, Mo.	6	112	8.34	*10.30*
Purina.	10	176	9.75	*10.30*
	7	222	9.93	*10.30*
	10	287	10.34	*10.30*
	4	340	10.31	*10.30*
	1	361	9.90	*10.30*
	4	381	9.81	*10.30*
	1	465	10.43	*10.30*
	1	618	9.97	*10.30*
Average	52		9.70	*10.30*
Ralston Purina Company,	2	111	7.94	*10.34*
St. Louis, Mo.	3	371	9.59	*10.34*
Purina.	4	411	10.43	*10.34*
	1	468	10.06	*10.34*
	2	516	10.87	*10.34*
	3	627	10.16	*10.34*
Average	15		9.84	*10.34*
Ralston Purina Company,	13	358	10.62	*9.00*
St. Louis, Mo.	12	452	9.93	*9.00*
Purina.	11	517	10.12	*9.00*
	17	581	9.81	*9.00*
	17	632	10.75	*9.00*
Average	70		10.25	*9.00*
Valley Milling Company,	2	259	8.87	*7.50*
St. Louis, Mo.	2	343	8.72	*7.50*
Chimo.	7	380	7.93	*7.50*
	8	415	8.43	*7.50*
	6	469	8.81	*7.50*
	4	519	8.37	*7.50*
	5	577	8.50	*7.50*
	4	626	8.06	*7.50*
Average	38		8.46	*7.50*

OAT FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.75	*4.40*	59.01	*63.10*	13.75	*11.90*	9.82	5.48
4.30	*4.40*	59.70	*63.10*	12.76	*11.90*	9.97	4.93
4.45	*4.40*	58.41	*63.10*	12.34	*11.90*	10.07	4.98
4.06	*4.40*	56.40	*63.10*	13.11	*11.90*	10.93	5.57
4.05	*4.40*	56.49	*63.10*	13.23	*11.90*	10.45	5.44
4.02	*4.40*	58.26	*63.10*	12.05	*11.90*	9.75	5.61
4.00	*4.40*	57.25	*63.10*	12.38	*11.90*	10.32	6.15
4.14	*4.40*	58.56	*63.10*	11.95	*11.90*	10.45	5.09
4.00	*4.40*	60.34	*63.10*	12.43	*11.90*	7.90	4.90
4.45	*4.40*	57.44	*63.10*	13.56	*11.90*	9.12	5.46
4.12	*4.40*	58.18	*63.10*	12.76	*11.90*	9.88	5.36
4.04	*4.47*	61.96	*63.11*	11.72	*8.95*	9.62	4.72
4.02	*4.47*	57.52	*63.11*	12.25	*8.95*	10.78	5.84
3.30	*4.47*	57.39	*63.11*	14.12	*8.95*	8.60	6.16
3.93	*4.47*	61.85	*63.11*	10.84	*8.95*	8.24	5.08
4.48	*4.47*	57.51	*63.11*	13.15	*8.95*	9.61	4.38
3.26	*4.47*	58.36	*63.11*	12.97	*8.95*	10.86	4.39
3.84	*4.47*	59.10	*63.11*	12.51	*8.95*	9.62	5.09
3.98	*4.50*	58.37	*59.70*	11.70	*13.30*	10.51	4.82
4.43	*4.50*	60.31	*59.70*	12.15	*13.30*	8.36	4.82
4.00	*4.50*	57.74	*59.70*	13.07	*13.30*	10.19	4.88
3.72	*4.50*	58.92	*59.70*	12.15	*13.30*	10.75	4.65
2.91	*4.50*	60.51	*59.70*	12.81	*13.30*	8.26	4.76
3.81	*4.50*	59.17	*59.70*	12.38	*13.30*	9.61	4.78
5.18	*4.50*	59.55	*59.00*	11.42	*14.00*	10.25	4.73
5.22	*4.50*	61.69	*59.00*	10.80	*14.00*	9.32	4.25
4.35	*4.50*	59.44	*59.00*	13.45	*14.00*	9.66	5.17
4.66	*4.50*	60.80	*59.00*	12.06	*14.00*	9.11	4.94
5.00	*4.50*	61.18	*59.00*	11.79	*14.00*	8.59	4.63
4.17	*4.50*	61.53	*59.00*	11.83	*14.00*	10.27	3.83
4.52	*4.50*	62.28	*59.00*	11.57	*14.00*	9.20	3.93
4.29	*4.50*	60.29	*59.00*	13.84	*14.00*	9.41	4.11
4.68	*4.50*	60.84	*59.00*	12.09	*14.00*	9.48	4.45

CORN AND

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guar-anteed
Valley Milling Company, **St. Louis, Mo.** Delta.	9	45	8.50	*7.50*
	11	64	8.19	*7.50*
	8	113	8.56	*7.50*
	10	165	8.44	*7.50*
	14	215	8.31	*7.50*
	12	283	8 37	*7.50*
	14	348	8.37	*7.50*
	8	379	8.31	*7.50*
	5	416	8.31	*7.50*
	15	455	8.62	*7.50*
	9	514	8.34	*7.50*
	11	579	8.49	*7.50*
	10	628	8.31	*7.50*
Average	136		8.40	*7.50*
Valley Milling Company, **St. Louis, Mo.** Eagle.	3	264	8.56	*7.50*
	1	410	8.87	*7.50*
	2	463	8 68	*7.50*
	1	504	8.56	*7.50*
Average	7		8.67	*7.50*

OAT FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
5.12	4.50	61.06	59.00	10.84	14.00	8.67	5.81
5.02	4.50	60.68	59.00	10.70	14.00	9.81	5.60
5.75	4.50	60.28	59.00	10.12	14.00	9.20	6.09
4.97	4.50	58.43	59.00	10.67	14.00	9.45	8.04
4.85	4.50	57.40	59.00	10.80	14.00	11.18	7.46
4.79	4.50	61.66	59.00	11.02	14.00	9.39	4.77
4.65	4.50	60.82	59.00	11.22	14.00	9.98	4.96
4.78	4.50	61.98	59.00	10.98	14.00	8.97	4.98
4.38	4.50	61.88	59.00	12.13	14.00	8.81	4.49
4.63	4.50	63.44	59.00	11.25	14.00	7.75	4.31
4.50	4.50	61.35	59.00	11.62	14.00	9.62	4.57
4.38	4.50	62.32	59.00	9.75	14.00	11.08	3.98
5.57	4.50	58.01	59.00	12.79	14.00	10.27	5.05
4.88	4.50	60.72	59.00	11.05	14.00	9.54	5.41
5.58	4.50	62.12	59.00	8.47	14.00	8.08	7.19
3.72	4.50	62.04	59.00	12.11	14.00	8.56	4.70
4.28	4.50	62.79	59.00	12.26	14.00	7.73	4.26
3.27	4.50	64.94	59.00	10.85	14.00	8.40	3.98
4.21	4.50	62.98	59.00	10.92	14.00	8.19	5.03

WHEAT BRAN AND

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Blair Milling Company, **Atchinson, Kan.** Wheat Bran.	2	41	15.50	*13.93*
	2	147	14.43	*13.93*
	1	244	13.53	*13.93*
Average	5		14.49	*13.93*
Blair Milling Company, **Atchinson, Kan.** Wheat Bran.	1	54	17.25	*16.75*
	2	141	16.81	*16.75*
	2	216	14.62	*16.75*
Average	5		16.23	*16.75*
City Grain and Feed Company, **Columbia, Tenn.** Mixed Bran.	2	262	9.56	*11.53*
	3	345	11.12	*11.53*
	1	417	9.50	*11.53*
Average	6		10.06	*11.53*
Dahnke-Walker Milling Company, **Union City, Tenn.** Mixed Bran.	1	57	12.31	*10.00*
	4	86	10.63	*10.00*
	4	194	11.75	*10.00*
	1	309	11.18	*10.00*
	1	554	13.06	*10.00*
Average	11		11.79	*10.00*
Hunter Bros., **St. Louis, Mo.** Wheat Bran.	1	610	16.41	*15.75*
Jones & Whitaker, **Baton Rouge, La.** Mill Run Bran.	1	243	16.22	*16.93*
Kelly & Lysle Milling Company, **Leavenworth, Kan.** Wheat Bran.	2	609	14.84	*15.40*

MIXED FEED

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.68	*3.50*	52.73	*56.84*	9.88	*10.59*	11.81	6 49
4.47	*3.50*	53.16	*56.84*	9.75	*10.59*	11.24	6.95
5.02	*3.50*	55.69	*56.84*	8.98	*10.59*	9.72	7.06
4.39	*3.50*	53.86	*56.84*	9.54	*10.59*	10.92	6.80
4.97	*3.50*	56.77	*58.95*	5.91	*8.98*	10.54	4.56
4.59	*3.50*	58.38	*58.95*	6.39	*8.98*	9.30	4.53
4.72	*3.50*	59.67	*58.95*	5.36	*8.98*	11.48	4.15
4.76	*3.50*	58.27	*58.95*	5.89	*8.98*	10.44	4.41
2.38	*2.63*	53.88	*53.97*	19.80	*15.45*	10.35	4.03
2.64	*2.63*	54.85	*53.97*	16.33	*15.45*	9.75	5.31
2.66	*2.63*	53.67	*53.97*	19.10	*15.45*	9.55	5.52
2.56	*2.63*	54.14	*53.97*	18.41	*15.45*	9.88	4.95
3.20	*3.50*	55.53	*59.61*	13.34	*11.00*	10.72	4.90
4.61	*3.50*	56.20	*59.61*	13.71	*11.00*	9.70	5.15
3.58	*3.50*	54.56	*59.61*	14.79	*11.00*	10.46	4.86
3.35	*3.50*	53.84	*59.61*	16.27	*11.00*	10.52	4.84
3.61	*3.50*	53.65	*59.61*	12.11	*11.00*	12.32	5.25
3.67	*3.50*	54.74	*59.61*	14.04	*11.00*	10.76	5.00
2.48	*4.00*	55.99	*40.00*	8.17	*9.25*	10.95	6.00
4.30	*4.04*	55.58	*52.97*	7.77	*8.78*	10.38	5.75
4.64	*4.00*	52.14	*53.90*	10.77	*9.00*	10.73	6.88

WHEAT BRAN AND

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
H. A. Klyce & Co., **Dyersburg, Tenn.** Furfur Spica.	4	116	13.81	*10.27*
	4	187	10.34	*10.27*
	7	297	10.38	*10.27*
	3	363	9.18	*10.27*
	2	421	11.06	*10.27*
	5	454	12.12	*10.27*
	3	513	10.87	*10.27*
	2	582	10.31	*10.27*
Average	30		11.01	*10.27*
Lev. Fowler, **Shreveport, La.** Bran.	4	34	11.25	*10.97*
	2	163	12.06	*10.97*
	3	261	8.99	*10.97*
	2	319	6.81	*10.97*
	2	423	8.78	*10.97*
Average	13		9.58	*10.97*

MIXED FEED

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.48	*2.35*	53.33	*50.84*	16.08	*20.62*	9.50	3.80
2.75	*2.35*	56.36	*50.84*	17.63	*20.62*	9.25	3.67
3.03	*2.35*	55.13	*50.84*	16.70	*20.62*	10.77	3.99
2.65	*2.35*	56.85	*50.84*	16.90	*20.62*	10.65	3.77
2.90	*2.35*	53.98	*50.84*	16.95	*20.62*	10.50	4.61
3.74	*2.35*	53.38	*50.84*	17.25	*20.62*	8.48	5.03
3.60	*2.35*	53.62	*50.84*	16.91	*20.62*	10.22	4.78
2.97	*2.35*	53.58	*50.84*	17.74	*20.62*	11.18	4.22
3.14	*2.35*	54.52	*50.84*	17.02	*20.62*	10.07	4.24
4.39	*5.72*	42.29	*48.41*	20.45	*16.86*	10.09	11.53
4.28	*5.72*	45.30	*48.41*	18.64	*16.86*	8.86	10.86
2.40	*5.72*	42.22	*48.41*	24.26	*16.86*	8.66	13.47
1.89	*5.72*	34.87	*48.41*	31.58	*16.86*	9.39	15.46
3.15	*5.72*	39.36	*48.41*	24.75	*16.86*	11.21	12.75
3.22	*5.72*	40.81	*48.41*	23.94	*16.86*	9.64	12.81

MISCELLANEOUS

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
American Cereal Company, **Chicago, Ill.** Vim Oat Feed.	1	217	8.81	*5.50*
Corno Mills Company, **East St. Louis, Ill.** Corno. Corn, Oats, and Alfalfa.	2	263	9.75	*8.90*
	1	311	10.28	*8.90*
	6	413	9.06	*8.90*
	6	450	11.43	*8.90*
	6	521	9.25	*8.90*
	6	623	9.75	*8.90*
Average	27		9.92	*8.90*
Corno Mills Company, **East St. Louis, Ill.** Horse and Mule Feed. Corn, Oats and Alfalfa.	1	159	9.28	*10.50*
	8	219	10.28	*10.50*
	4	289	9.43	*10.50*
	9	342	9.31	*10.50*
	8	388	9.31	*10.50*
	4	414	9.68	*10.50*
	4	479	9.51	*10.50*
	10	520	9.40	*10.50*
	1	549	11.43	*10.50*
	13	580	9.06	*10.50*
	3	474	9.37	*10.50*
	7	636	9.39	*10.50*
Average	72		9.62	*10.50*
Corno Mills Company, **East St. Louis, Ill.** Creamo Dairy Feed. Corn, Oats, Gluten Meal and Alfalfa.	1	160	15.12	*15.50*
	3	246	14.15	*15.50*
	1	310	13.81	*15.50*
	2	350	13.03	*15.50*
	3	362	12.53	*15.50*
	3	458	11.46	*15.50*
	1	501	13.12	*15.50*
	1	502	12.24	*15.50*
	1	552	12.90	*15.50*
	2	634	12.75	*15.50*
Average	18		13.10	*15.50*

FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.16	*2.00*	63.75	*50.00*	9.50	*27.00*	11.82	2.96
3.73	*5.60*	55.58	*52.20*	16.32	*8.50*	9.80	4.82
3.98	*5.60*	57.33	*52.20*	12.88	*8.50*	10.67	4.86
3.39	*5.60*	59.09	*52.20*	13.97	*8.50*	9.91	4.58
3.63	*5.60*	59.17	*52.20*	12.80	*8.50*	8.75	4.22
3.41	*5.60*	57.83	*52.20*	14.45	*8.50*	10.37	4.69
3.11	*5.60*	57.75	*52.20*	14.38	*8 50*	10.18	4.83
3.58	*5.60*	57.77	*52.20*	14.13	*8.50*	9.94	4.66
4.28	*5.60*	58.83	*58.50*	14.16	*11.10*	9.22	4.23
4.00	*5.60*	57.76	*58.50*	11.47	*11.10*	11.98	4.51
3.60	*5.60*	58.33	*58.50*	13.30	*11.10*	11.16	4.18
3.42	*5.60*	57.70	*58.50*	14.87	*11.10*	9.32	5.38
3.37	*5.60*	57.52	*58.50*	14.69	*11.10*	10.38	4.73
3.51	*5.60*	59.63	*58.50*	13.40	*11.10*	8.91	4.87
3.59	*5.60*	59.66	*58.50*	13.81	*11.10*	8.70	4.73
3.67	*5.60*	59.64	*58.50*	13.09	*11.10*	9.85	4.35
2.96	*5.60*	54.96	*58.50*	13.98	*11.10*	11.84	4.83
2.86	*5.60*	60.29	*58.50*	12.97	*11.10*	10.70	4.12
3.51	*5.60*	59.91	*58.50*	13.40	*11.10*	9.33	4.48
2.91	*5.60*	59.30	*58.50*	14.38	*11.10*	9.32	4.70
3.47	*5.60*	58.63	*58.50*	13.63	*11.10*	10.06	4.59
3.86	*5.10*	48.55	*50.00*	19.01	*17.50*	8.07	5.39
3.85	*5.10*	48.70	*50.00*	18.87	*17.50*	8.58	5.85
3.90	*5.10*	50.19	*50.00*	17.33	*17.50*	9.44	5.33
3.40	*5.10*	48.40	*50.00*	19.77	*17.50*	9.65	5.75
3.24	*5.10*	48.77	*50.00*	19.30	*17.50*	10.44	5.72
3.74	*5.10*	52.56	*50.00*	17.66	*17.50*	9.15	5.43
3.62	*5.10*	50.49	*50.00*	19.36	*17.50*	7.79	5.62
3.17	*5.10*	49.95	*50.00*	21.00	*17.50*	7.76	5.88
3.38	*5.10*	49.26	*50.00*	17.24	*17.50*	11.94	5.28
1.90	*5.10*	50.41	*50.00*	19.32	*17.50*	9.60	6.02
3.41	*5.10*	49.73	*50.00*	18.89	*17.50*	9.24	5.63

MISCELLANEOUS

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Ralston Purina Company, **St. Louis, Mo.** Protena. Ground Alfalfa.	1	336	20.15	*20.00*
Ralston Purina Company, **St. Louis, Mo.** Protena. Principally Ground Alfalfa.	3	617	10.69	*10.00*
Valley Milling Company, **St. Louis, Mo.** Mula. Corn, Oats and Wheat Bran.	2	91	7.88	*6.00*
	4	162	8.37	*6.00*
	1	270	8.62	*6.00*
	1	307	7.87	*6.00*
	1	364	8.68	*6.00*
	1	486	8.50	*6.00*
	1	555	8.50	*6.00*
	3	624	8.06	*6.00*
Average	14		8.31	*6 00*

FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
5.42	*3.50*	39.80	*48.00*	18.23	*16.00*	8.68	7.72
2.99	*4.00*	53.7	*56.00*	16.94	*14.90*	10.06	5.56
5.33	*4.00*	64.19	*51.00*	9.24	*17.00*	8.10	5.26
4.27	*4.00*	60.54	*51.00*	10.83	*17.00*	9.24	6.75
4.84	*4.00*	56.42	*51.00*	14.98	*17.00*	8.51	6.63
4.47	*4.00*	61.50	*51.00*	9.46	*17.00*	11.02	5.68
4.15	*4.00*	60.13	*51.00*	10.49	*17.00*	10.83	5.72
3.90	*4.00*	62.96	*51.00*	12.18	*17.00*	8.53	3.93
3.54	*4.00*	63.64	*51.00*	9.90	*17.00*	10.34	4.08
2.51	*4.00*	58.85	*51.00*	14.63	*17.00*	10.60	5.35
4.13	*4.00*	61.03	*51.00*	11.46	*17.00*	9.65	5.42

BREWERS

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Atlas Feed Company, **New Orleans, La.**	2	351	21.06	*22.00*
	3	420	20.68	*22.00*
	1	466	20.38	*22.00*
	2	584	22.12	*22.00*
	2	615	24.66	*22.00*
Average	10		21.78	*22.00*
R. H. Polack, **New Orleans, La.**	1	19	24.00	*23.81*
	1	174	20.70	*23.81*
	5	288	20.49	*23.81*
	1	422	22.55	*23 81*
	3	459	23.43	*23.81*
	2	511	25.81	*23.81*
	1	551	20.93	*23.81*
	5	639	22.75	*23.81*
Average	19		22.58	*23.81*

GRAINS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
6.60	*7.00*	42.53	*45.00*	17.06	*11.00*	8.50	4.25
6.65	*7.00*	42.51	*45.00*	17.54	*11.00*	8.35	4.27
6.01	*7.00*	43.15	*45.00*	18.33	*11.00*	7.81	4.32
5.50	*7.00*	41.63	*45.00*	16.79	*11.00*	10.32	3.64
4.93	*7.00*	40.95	*45.00*	15.79	*11.00*	9.78	3.89
5.94	*7.00*	42.15	*45.00*	17.11	*11.00*	8.95	4.07
7.10	*7.02*	43.77	*37.63*	12.51	*16.77*	8.39	4.23
7.20	*7.02*	42.69	*37.63*	16.16	*16.77*	8.99	4.26
6.30	*7.02*	41.12	*37.63*	18.18	*16.77*	9.72	4.19
6.90	*7.02*	40.17	*37.63*	16.51	*16.77*	9.65	4.22
6.99	*7.02*	41.57	*37.63*	16.10	*16.77*	7.68	4.23
7.80	*7.02*	39.19	*37.63*	14.29	*16.77*	8.86	4.05
6.52	*7.02*	41.26	*37.63*	17.97	*16.77*	9.09	4.23
6.79	*7.02*	41.35	*37.63*	16.91	*16.77*	7.46	4.74
6.95	*7.02*	41.40	*37.63*	16.08	*16.77*	8.73	4.26

POULTRY

Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Armour Packing Company, Kansas City, Kan.				
Beef Scraps.	1	394	55 87	*48.00*
Animal Blood Meal.	1	375	54.81	....
Helmet Meat and Bone Meal.	1	352	53.81	*52.00*
Fine Poultry Bone.	1	393	23.37	*22.00*

FEEDS

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
19.33	*26.00*	......	......	1.63	*5.00*	......	......
10.28	......	......	......	......	......	......	......
9.78	*4.00*	......	......	......	......	......	......
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Louisiana Bulletin No. 89. December, 1906.

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College.

BATON ROUGE

Nodule-Disease of the Intestines of Sheep.

"BARE-LOT" METHOD OF RAISING LAMBS.

Results of Further Experimental Work.

Nodule-Diseased Ewe With Lamb.

By W. H. DALYRMPLE, M. R. C. V. S.

BATON ROUGE:
THE TIMES PUBLISHING COMPANY.
1906.

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The Bulletins and Reports will be sent free of charge to all farmers, by applying to the Director of the Stations, Baton Rouge, La.

NODULE-DISEASE OF THE INTESTINES OF SHEEP.

"BARE-LOT" METHOD OF RAISING LAMBS.

RESULTS OF FURTHER EXPERIMENTAL WORK.

By W. H. Dalrymple.

The "bare-lot" method of endeavoring to raise lambs free from nodule-disease of the intestines, while, at the same time permitting them to run with their diseased mothers, was first undertaken by the Veterinary Division of the Experiment Station last year (1905), beginning the early part of February—when the in-lamb ewes were placed in the lot—and continuing until July, when the lambs were examined (post-mortem) for results, which latter have already been published in Station Bulletin No. 83.

In order to serve as a "link," however, between the work of last year and the outcome of that covered by this bulletin, we here reproduce our deductions which we believe we were justified in making, as the result of the former:

"(1) That, by the bare-lot method, it is possible to raise lambs, up to the period of weaning, and without separating them from their affected mothers, practically free from nodule-disease of the intestines.

"(2) That, in the absence of intestinal parasites, other than the nodule-disease worm, lambs intended for feeding for the early, or other markets, may be raised in this way, without their health being impaired, or their general condition affected, by the disease.

"(3) That, in the case of ewe-lambs to be kept for breeding purposes, and which may have become only slightly infested, there is the possibility, owing to the life-history of the parasite as given by helminthologists (those who make a special study of worms), of auto-infestation and subsequent infection of clean pastures on which the lambs may have been placed.

"(4) That, although the previous deduction as to such possibility may be correct, there can hardly be any question as to the great reduction in the primary infestation by the bare-lot method, as compared to that brought about where the lambs are permitted to graze on pasture infected through the droppings of their diseased mothers.

"(5) That, the method is so simple and so free from technicalities, that any flockmaster who will take the trouble to observe ordinary care as to a few details, may obtain, at least, fair results from its adoption.

"(6) That, with the supply of some good vermifuge mixture to which the sheep can have access at all times, in conjunction with the bare lot method, more satisfactory results might be looked for than was even obtained in our experiment.

"(7) That, when the lot becomes infected with other intestinal parasites, such as stomach worms, tape worms, etc., the method, alone, will not prevent infestation of the lambs with such parasites.

"(8) That, the method is worthy of trial by flockmasters owning breeding ewes affected with nodule-disease of the intestines."

Owing to the results of the previous year's work—upon which the above deductions were based—showing a measure of practical success, and on account of encouraging comments upon the work, from various sources, and suggestions that duplicate, or other, tests be undertaken along similar lines, the Station determined to carry on some further experimental work during the present year.

The lot (illustrated and described in Bulletin No. 83) was ploughed and harrowed, and all vegetation got rid of that had grown in the interim, and with the view of turning under any infection that might have remained over after the experiments of the previous year. The lot was then divided into halves by running a wire-net fence lengthwise, through it. Our object in making two lots was to duplicate the experiment of last year in one of the divisions, and in the other, to use common salt, as a vermifuge and tonic, in the feed of its occupants. In other words, the two lots, and the general treatment of the ewes and lambs were identical, with the single exception, that common salt was mixed with the grain feed in one of the lots only.

Eight common native ewes of mixed breeding were purchased by the Station from a flock that was known to be affected with nodule-disease, and, consequently, with the specific worm—*Oesophagostoma columbianum.* And not only so, but the ewes were afterwards found to be badly infested with both tape worms and stomach worms in addition, which, no doubt, militated, to a considerable extent, against our obtaining maximum good results, so far as the final outcome of the condition of the lambs was concerned.

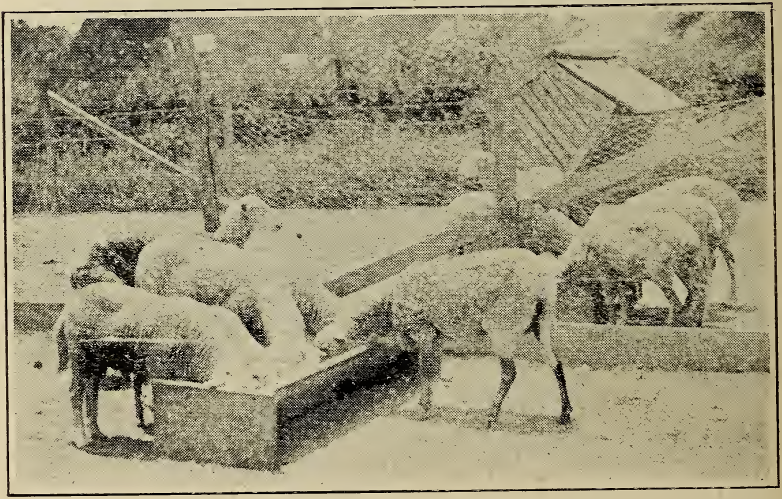
A Specimen of the Nodule-Diseased Ewes.

From the eight ewes, five lambs were obtained, one being a twin and of undersize.

All of the lambs were born in the lots between February 16 and March 5, 1906.

The ewes were equally divided, four being placed in each lot; the three oldest lambs, with their mothers, occupying the one in which the duplicate work of the previous year was undertaken, and which we will designate the "east lot." The remaining ewes, with the two youngest lambs, occupied the lot in which the salt was added to the feed, and which we will call the "west lot."

As the details of the plan of this work, with the exception of the added salt to the feed in one of the lots, are fully described in Station Bulletin No. 83, we may omit them here and refer the reader to that publication; and for a description of the disease, itself, to Station Bulletin No. 79.



Showing Ewes and Lambs in Both Lots.

In using a vermifuge, the idea at first was to provide, instead of salt, a mixture suggested in "Animal Parasites of Sheep," a publication of the National Bureau of Animal Industry, and composed of the following ingredients: Pulverized rosin, 1 part; sublimed sulphur, 2 parts; air-slacked lime, 4 parts, and common salt, 16 parts. These materials were thoroughly mixed and placed in a small wooden box protected from the weather, and to which both ewes and lambs (in the west lot) could have access at all times. This may, doubtless, be quite a useful worm mixture, under ordinary circumstances, but, as the lambs were slow to voluntarily partake of it, and as it was thought possible that infestation might occur in them before they had acquired a taste for the mixture, it was decided to abandon its use and resort to the mixing of a small quantity of common salt, alone, with the grain feed twice daily, which we knew would be consumed with the food. Had we used the mixture in this way, more favorable results might, possibly, have been secured.

The ewes were sold on August 2, 1906, and the lambs weaned and fed until September 8th, when they were butchered and examined.

Just previous to slaughter, the lambs from each lot were weighed. The weights of the three older ones which had occupied the east lot (without salt) aggregated 165 pounds. The two younger lambs, taken from the west lot, where salt had been given, weighed, together, 133 pounds.

RESULTS OF POST-MORTEM EXAMINATIONS.

(East Lot.)

Ram lamb (71 pounds, live weight):

Stomach worms *(Strongylus* or *Haemonchus contortus)*, numerous. Tape worm *(Taenia expansa)* present. No nodules discernible on any part of the intestines.

CORNER OF EAST LOT.
The Three Oldest Lambs Which Did Not Receive Salt in Their Feed.

Small ewe lamb (40 pounds, live weight):

Stomach worms, very few. Tape worm present. Two "pinhead," and one larger caseous, nodules, on the cæcum and colon.

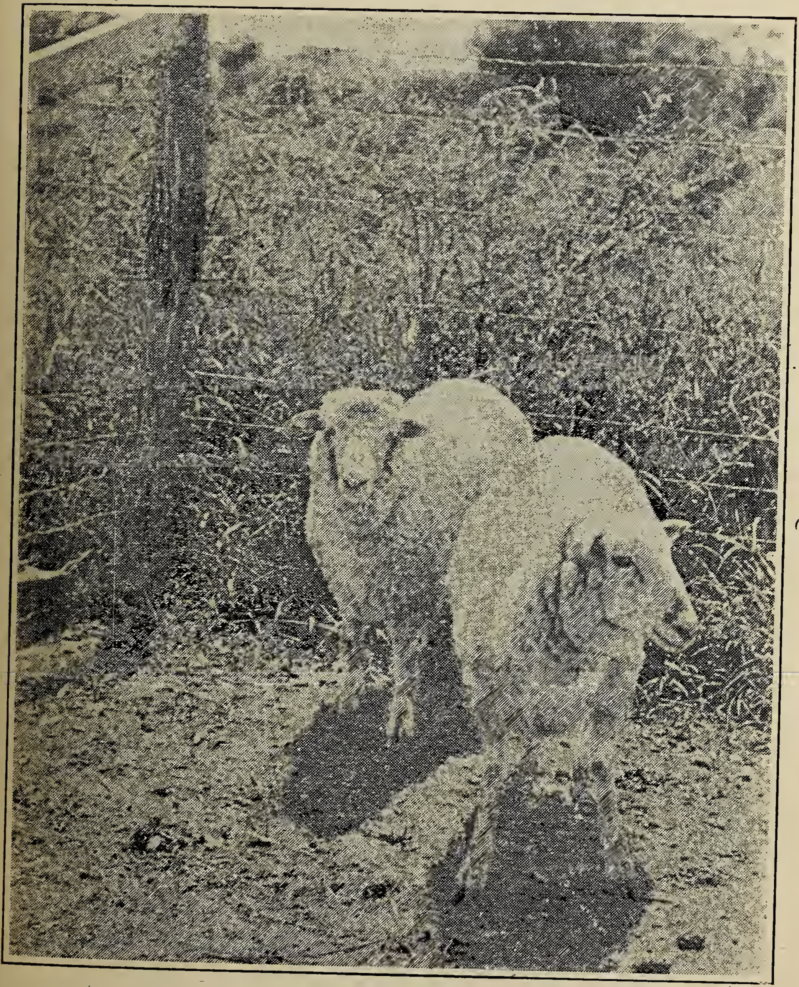
Larger ewe lamb (54 pounds, live weight):

Stomach worms, numerous. Two caseous nodules, one on the cæcum, the other on the small intestine. No tape worm present.

(West Lot.)

Ram lamb (74 pounds, live weight):

Stomach worms, numerous. Tape worm present. Two caseous nodules on cæcum and colon.



CORNER OF WEST LOT.
The Two Youngest Lambs Which Received Salt in Their Feed.

Ewe lamb (59 pounds, live weight):

Stomach worms, numerous. No tape worm present. About forty nodules, of different sizes, on cæcum and colon, and others scattered along the small intestine.

Remarks: By glancing over the results, it will be observed that the lambs in both lots were infested with stomach worms; that one lamb out of each lot did not have any tape worm; that one of the lambs receiving salt had about as many nodules as, and the other a great many more than, any of those which did not receive salt. While one of the lambs receiving no salt, did not have any nodules.

From the above it seems reasonable to conclude that salt given with the food did not have any beneficial effect as a vermifuge in this particular experiment. On the other hand, the two lambs receiving salt seemed to thrive better, as indicated by their weights, in spite of the greater degree of parasitism, although they were both younger than any of the lambs in the lot where salt had been withheld.

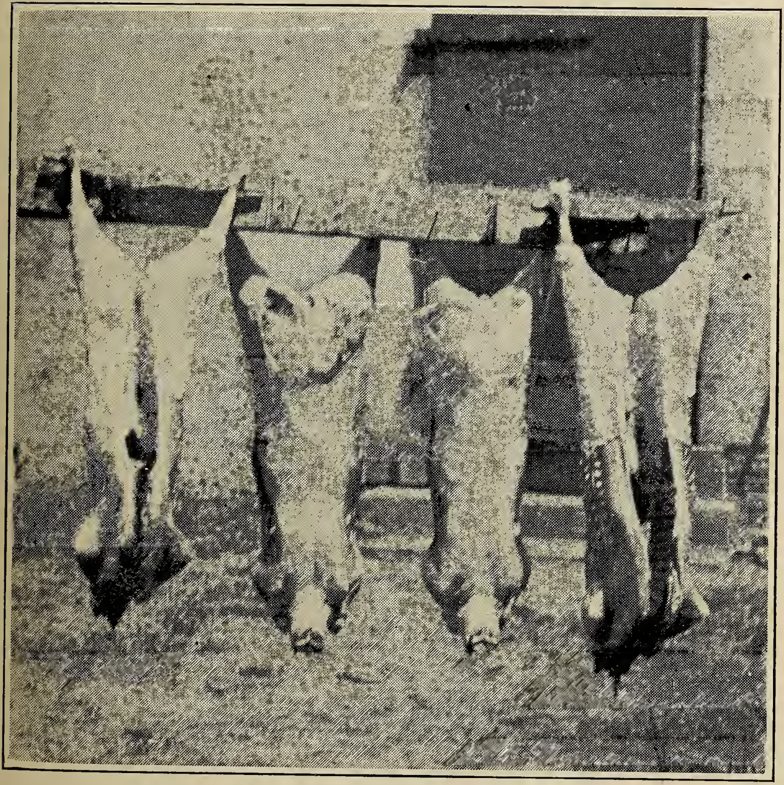
As all of the lambs were more or less uniform as to breeding, the quicker growth and greater apparent thriftiness of the two younger ones, could not be due to their being of better quality than the others. It is the writer's opinion that the difference was due rather to the influence of the salt in aiding digestion and assisting in the more thorough assimilation of the nutritive matters of the food consumed; and which would seem to indicate that a sufficiency of common salt is a valuable adjunct to the food of sheep under any and all conditions.

We would again refer to the fact, that all of the ewes (mothers) were very heavily infested, not only with nodule-disease worms, but, also, with other intestinal parasites; which hardly affords a fair basis for comparison as to what the general growth and development of the lambs might have been, had they only had to contend with the effect of the nodule-affection which was found on post-mortem; or, that of a flock of lambs on the farm, where nodule-disease, only, affected the mothers.

In comparing this year's experiments with last—the part of the work in the east lot being a duplication—it will be observed that the results are almost identical; which would seem to substantiate the deductions then made, and which have been reproduced in an earlier part of this bulletin.

With regard to the administration of common salt along with the grain feed, no apparent benefit was derived from it as a vermifuge; but that its influence upon the digestion and assimilation of the food consumed, seems not only to warrant, but commend, its use, as an adjunct to the feed of sheep at all times.

After the carcasses were dressed, a photograph was taken of the four largest of them, which shows, that the lambs, although somewhat small, had been very fairly nourished.



Dressed Carcasses of the Four Largest Lambs.

Those who purchased portions of these carcasses from the butcher, for table use, were unanimous in the statement, that the meat was of most excellent quality.

Return to Forage Crop Investigation files.

Louisiana Bulletin No. 90. January, 1907.

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College,

BATON ROUGE.

SUMMARY OF RESULTS

WITH

VEGETABLES AND FRUITS

AT THE

North Louisiana Experiment Station

FROM

1892 TO 1907.

By E. J. WATSON, Horticulturist.

BATON ROUGE:
THE TIMES PUBLISHING COMPANY,
1907.

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The Bulletins and Reports will be sent free of charge to all farmers by applying to the Director of the Stations. Baton Rouge, La.

Summary of Horticultural Work

AT THE

North Louisiana Experiment Station,

FROM 1892 TO 1907.

WITH NOTES ON

CANNING FRUITS AND VEGETABLES.

INTRODUCTORY.

In January, 1892, the writer was placed in charge of the fruit and vegetable experiments inaugurated by the North Louisiana Station. Prior to that date no systematic work had been undertaken in these lines. Therefore, the work summarized in this Bulletin represents practically all the results secured by experiments at Calhoun to date.

The field was a new one; little, or no definite information was available regarding the horticultural possibilities of North Louisiana and the problems to be solved in connection therewith. Therefore, much of the work undertaken was of a "pioneer" character, and naturally enough, some mistakes were made, which necessitated the duplication of much of the work.

The work has continued uninterruptedly, and has been developed through successive stages, to the point where it is now deemed advisable to bring together the results as a whole, so that safe and reliable deductions might be drawn as to what can be expected as the average of growth, quality and general behavior of any given crop through a series of years, and under varying conditions of weather, insects and fungus attacks, and other deleterious influences that are commonly met with in general garden and farm operations.

The first four years were devoted almost entirely to the testing of the different species of fruits and vegetables, and the numerous commercial varieties of each, with the view of determining the relative merits of each for this particular section, as well as their merits in general; and incidentally, to stimulating a more general and intelligent interest in home and market gardening. During this period, the commercial side of gardening was only touched upon incidentally, and as only small plats were devoted to each crop, the yields, etc., were determined on a scale of zero to ten.

Beginning with the season of 1896, and continuing up to 1904, the work of the vegetable garden was devoted chiefly to experiments with home grown versus bought, or commercial seeds, using for this purpose all the leading commercial varieties of the most important vegetables commonly grown in the South. The results of these experiments are found in Bulletin No. 68, entitled "Home Grown vs. Purchased Seeds."

Beginning with the season of 1904, the commercial side of gardening, or truck growing was taken up, and for the past three years our efforts have been devoted mainly in this direction. This work, as a whole, has been fairly successful and useful in stimulating interest and inquiry in this important industry in this section, although we have not always been successful in making profitable sales of some of the crops grown. Along with these experiments in trucking, considerable work has been done in the canning of vegetables and fruits, especially tomatoes and peaches, utilizing the surplus that remained after shipments became unprofitable. In the winter of 1904 a preliminary report was made on both phazes of this work, and later published as Bulletin No. 81. There is a widespread and constant demand for this Bulletin.

The average conditions obtaining in North Louisiana as regards soil, climate, etc., and their influence on the growth of early vegetables, and the blooming and development of fruits, are highly favorable, although occasionally a cold, wet spring with frosty nights, will ensue, followed by dry weather in May and June, thus materially reducing the yields and injuring the quality of the products, but such conditions, when they occur, are more or less general, and not confined to any particular section.

As regards fruits, the data at hand, secured during the past fourteen years, does not show up so favorably as that of vegetables, for the reason that the climate is not adapted to the successful culture of many of the fruits reported on, except to a limited extent.

It is not intended that this Bulletin should be complete in all necessary details concerning gardening and fruit growing, as our purpose is to avoid the repetition of anything already published. (If the reader wishes to know anything about the construction of hot-beds and cold-frames and their operation, and the uses of fertilizers for fruits and vegetables, he is referred to Bulletin No. 81.) This Bulletin is divided into the following heads or divisions: (1) Results with vegetables; (2) Results with fruits; (3) Condensed information on canning fruits and vegetables.

RESULTS WITH VEGETABLES.

Cabbage.

For six consecutive years the varieties named below were under test, and the following are the least desirable kinds, ranging below five on a scale of zero to ten, as to quality, productiveness, etc.: Dwarf Savoy, Drumhead Savoy, Green Glazed, Early York, Oxheart and World-Beater.

The following are the most desirable and successful sorts, ranging in productiveness from six to ten: Large Early York. Early Jersey Wakefield, Charleston Wakefield, Early Flat Dutch, Late Flat Dutch, Improved Brunswick, Solid South, Early Summer Succession, St. Denis, All Seasons, Early Drumhead and Late Drumhead.

The planting of the seed has usually been done in the cold-frame about February 1, for the general test, but in the trucking experiments, where earliness of maturity is the prime object, the first planting was usually made from the 25th of November to the 1st of December. When planted on the latter date, the plants are ready for the field about February 1, but usually, owing to freezing weather, they are held back until the 20th or 25th. Those planted on the former date, February 1, grow off much more rapidly, and are ready for the field by March 5, although they are later in maturing than those planted earlier.

The average period from seed planting to marketable maturity, with the standard early sorts, such as the Wakefield, has been 105 days, or three and one-half months, taking February 1 as our average date of planting, and May 15 as the average date when marketing of the crop. The crop usually runs over, however, about two weeks, and ends with the coming in of the later sorts, such as the Early Flat Dutch, about June 1. The later varieties named above furnish a succession up to August 1.

With the yields, there has been a considerable variation from year to year, according to the general character of the season, there never having been a failure during the entire period. As previously stated, the yields per acre were not obtained, but results were measured on a scale of zero to ten. The highest averages during the test have been made by Succession, Early Flat Dutch and Solid South, in the order named. With the trucking experiments, the Early Wakefield, a low average yielder, was used exclusively; first, because of its extreme earliness, and, second, it combines the size and shape generally preferred by the larger markets during the early part of the season.

For the last three seasons, since the yields per acre have been obtained, the average yield per acre has been 12,666 pounds, and the average price at which the crop has been sold, f. o. b., was two cents per pound. In the general variety test, an abundant supply of stable manure was used as a fertilizer, but in our trucking experiments, commercial fertilizer only has been used, at the average rate of 1,200 pounds per acre, consisting of the following formula: Cotton seed meal, 600 pounds; nitrate soda, 200 pounds; acid phosphate, 400 pounds.

These experiments certainly indicate the possibilities of cabbage culture on these soils, and the fact that not a single failure has been made in fourteen years, is certainly worth consideration.

Beans.

The tests of beans have been extensive and thorough, including every class of this vegetable usually found in the American garden. For ten years a large number of varieties were grown continuously, and the results recorded on a scale of zero to ten. In only three instances an unprofitable yield of the early spring crop has resulted, viz: 1896, due to extreme dry weather; 1904 and 1905, due to cold and backward weather during April and May. These latter remarks apply particularly to the bush or snap beans, which are usually planted as early as the weather will permit. The Lima or butter beans are planted later, and consequently are not subject to the retarding influences of the early spring season, but in two instances they were cut off by the extreme drouth of summer, viz: 1896 and 1897.

The Bush Beans.

This class of beans is particularly adapted to the needs of the market gardener and trucker, on account of their earliness and ease of culture. The pole or running varieties are better suited to the home garden. From the 20th to the 30th of March is the general average period in which we have been able to make our first plantings. In a few instances, successful plantings have been made by the 10th of March, and in especially favorable situations, they could doubtless be successfully planted by the 1st of March, but the controlling conditions of weather vary widely in this respect.

The average length of time from planting to marketable maturity is approximately fifty days; some of the extra early kinds will furnish pickings in forty-five days, under favorable conditions. From the market standpoint this is a very important question. On the 20th of May we have secured as high as $2 per bushel, and immediately afterward the prices began to decline, until by the 5th of June only 75 cents per bushel was obtainable. Our general experience establishes the fact that the main crop for market should be planted so as to be ready not later than the 15th of May, and earlier if possible.

The varieties giving the highest average yields, quality, freedom from rust, etc., are as follows: Improved Red Valentine, Wardwell's Kidney Wax, Early Mohawk, Pride of Newtown, Stringless Green Pod, Early Refugee, Best of All, Yellow Six-Weeks, Dwarf German Wax and Marvel of Paris. On the whole, the average date of marketing has been between May 20th and 30th; the average yield, 150 bushels per acre, and the average prices received, $1.75 per bushel.

The Pole Beans.

These are planted about the same time as the bush varieties, but do not come into bearing sufficiently early for market purposes. They are, however, superior for home use. From our tests with these, the varieties that stand highest in point of yield, quality, etc., are the Creaseback, Kentucky Wonder, Southern Prolific and Golden Cluster Wax, in the order named.

The Bush Limas.

This is a most valuable acquisition. There are two types of these: the Sewee, or butter, and the true Limas. The former is as hardy as the regular snap bean, and ordinarily can be planted about the same date. Several varieties of this class have been thoroughly tested, and only two, viz: Henderson's and

Jackson's "Wonder," found reliable. The latter gave the highest average yield, but has the disadvantage of "colored" seeds, which makes it unpopular as a market bean. Henderson's is in every way reliable, and by making successive plantings, a supply can be kept up throughout the season. We have been able to get the latter on the market by June 10, and the average price at that time was $1 per bushel. They have made an average yield of 100 bushels per acre, and from two to three crops can be grown during the season.

The Pole Limas.

These constitute a valuable market garden crop, and several of the varieties possess great drouth resisting powers, and will continue to bear throughout the season. The best average results have been obtained from the Sewee, or butter type. This type is especially adapted to the South. The Large Limas have not been generally successful here.

Beets.

For ten years consecutively the following varieties of beets were under test: Early Blood Turnip, Long Blood, Half-Long Blood, Dewing Early Red, Crosby's Egyptian, Eclipse, Lentz, Queen, Extra Early Egyptian, Bassano, Edmund's Early Red, Long Red Mangel (stock beet), White French Sugar and Swiss Chard (salad beet).

The average date of planting was February 15; the average date of marketable maturity, May 15. The varieties giving the highest average in point of earliness, and other desirable characteristics, are as follows, named in the order of their respective merits: Extra Early Egyptian, Early Blood Turnip, Eclipse and Lentz. These furnish a succession from May 10 to midsummer. The highest average yield has been from Early Blood Turnip, followed by Eclipse. The mean average yielder being Extra Early Egyptian, the variety used in the trucking experiments, the average yield being 150 bushels per acre, ready for market by May 10, the average price received being 75 cents per bushel.

The Long Red Mangel stock beet has given uniformly good results, but for feeding purposes should be sown in September and fed during winter and early spring. The White French

Sugar is also an excellent yielder, and valuable for feeding purposes. The Swiss Chard has given excellent results, but is not a popular vegetable in the South. Well rotted stable manure has been the only fertilizer used on beets.

Cucumbers.

The cucumber is one of the most important market garden crops, and in order to obtain profitable prices it is necessary to have them ready for market at the earliest possible date. This is accomplished by starting them in the hot bed early in the season, sowing the seed in soil bands and transferring the plants to the field after danger of frost is past. But in these experiments the seed have been sown in the open ground as soon as the weather conditions would permit. This practice gives a fairly reliable idea of what can be expected under ordinary conditions.

For twelve consecutive seasons the following varieties have been thoroughly tested: Early Green Cluster, Long Green Turkey, New Orleans Market, Early Frame, White Spine, Peerless, Early Russian and Giant Pera.

The average date of planting was March 25, and the average length of time from planting to marketable maturity, approximately fifty days, for the earlier kinds. The varieties giving the best general satisfaction in point of earliness, yield, etc., are as follows, named in the order of their merits: Early Green Cluster, White Spine, New Orleans Market and Long Green Turkey.

For the past three years the average yield has been 192 bushels per acre, the average date of marketing, May 20, and 75 cents per bushel the average price received at that date. Ten days earlier the prices were averaging $2 per bushel, and ten days later 50 cents. All things considered, it is better to risk a planting in March, and in case the first fails, plant again, as our experience proves conclusively that to receive anything like paying prices the crop should come on the market not later than May 15.

Eggplants.

The eggplant has been grown successfully for eight years of the fourteen. For four years it was not grown, and for two it was a failure, due to extreme drouth. The following varieties were under test: Pearl White, Dwarf Purple, New York Market, Large Purple, or New Orleans Market.

The method pursued in growing them was to plant the seed in the hot-bed about the 1st of February, transfer to cold-frame during March and later to the field after growing weather has set in. Much care is necessary in handling the young plants in the hot-bed to prevent "damping off."

The average time from seed bed to market was approximately 140 days—from February 1 to June 25, on which date the first shipments have been made. On this date an average price of $1.25 per bushel was obtained. These prices, however, are for the local markets. The northern markets were paying at the same dates from $1.50 to $2 per bushel.

It is only for the two seasons past (1905 and 1906) that this vegetable has been grown commercially, and the results have proved highly successful. An average yield of 320 bushels per acre has been secured for the two seasons, the average period of marketable maturity, June 25, and the average prices received, 75 cents per bushel. With proper care the eggplant will continue to produce fruit until killed by frost, about the first of November. In the variety tests, stable manure alone was used, but in the trucking experiments, the same quantity and formula as given for cabbage was used.

Lettuce.

No commercial results from lettuce were obtained, as it was not included in the trucking experiments, but for ten successive seasons the following varieties were under test, and uniformly good results were obtained: Drumhead Cabbage, Deacon, Denver Market, White Summer Cabbage, White Cos, Trianon Cos, Perpignan, New Orleans Passion, Royal Cabbage, Philadelphia Dutch Butter, Brown Dutch Cabbage, Hanson, Curled Simpson, Trocadero and French Market. These were planted in the cold-frame and later transferred to the field; the average date of planting being February 1, and of setting in the open ground, March 10.

The average period from planting to market was approximately, 90 days, from February 1 to May 1, the average date of marketable maturity. The varieties giving the best general satisfaction in point of earliness, yield, quality, etc., are as follows, named in the order of their respective records: Drumhead

Cabbage, White Summer Cabbage, White Cos, New Orleans Passion, Deacon and French Market.

Lettuce is generally packed in barrels for market, and the daily reports from the large markets show an average price of $3.50 per barrel from May 1 to June 1. Under out-door conditions these experiments indicate that May 1 is about as early as lettuce can be brought to marketable maturity in this latitude. Well rotted stable manure was used exclusively on these experiments.

Cantaloupes.

It seems quite certain that the cantaloupe will be one of the most important commercial truck crops in the coming development of the truck industry in North Louisiana. It was the subject of careful attention throughout the whole period of these experiments, and on the whole, very satisfactory results were secured. The cantaloupe requires considerable moisture for its highest development, and for two seasons, viz: 1896 and 1897, the crop was practically a failure, owing to the lack of sufficient moisture.

The following varieties were under test for ten consecutive seasons: Long Island Beauty, White Japan, Chicago Nutmeg, Augusta Market, Melrose, Osage, Early Hackensack, Pineapple, Netted Nutmeg, Netted Citron, the Nixon, Cosmopolitan, New Orleans Market, Rocky Ford, Anne Arundel, Acme, Jenny Lind, Delmonico, Banana, Persian or Cassaba.

In every instance the seed was planted in the open ground, the average date of planting for all of the years being March 25: sometimes they were planted earlier, often later, according to the conditions of weather. The period of ripening varies considerably, according to the variety and character of season. If the season be dry, the melons mature earlier than during wet seasons. Thus, while the average period of planting has varied but little, the period of maturity has varied from June 15 to July 10, the general average being June 25.

Of the above list of varieties, those making the best average record on the points of earliness, yield, quality, etc., are as follows: New Orleans Market, Rocky Ford, Chicago Nutmeg, Anne Arundel, Baltimore, or Acme, Delmonico, Long Island

Beauty, Early Hackensack, White Japan and Pineapple. Any or all of these varieties are excellent for home use and local markets at the present time, and for this purpose the Rocky Ford has practically superseded all others, and in our trucking experiments this variety was used exclusively. Cantaloupes are usually packed for market in slatted crates, 12x12x24 inches, holding on the average 45 melons. For the past three seasons our average yield has been 60 crates per acre, the first shipments being made about the 22d of June, and the prices received from that date up to the 10th of July averaging $2 per crate. The fertilizer used in these experiments was the same in quantity and formula as given for cabbage.

Watermelons.

From the beginning of these experiments the watermelon has been the subject of special attention, and all the leading varieties now on the market have been thoroughly tried and the results recorded from year to year. The following varieties were under test for twelve consecutive years: Seminole, Florida Favorite, Kolb Gem, Lone Star, Ice Cream, Southern Rattlesnake, Sugar Loaf, Pride of Georgia, Duke Jones, Joe Johnston, Vaucluse, Hungarian Honey, Ruby Gold, the Boss, Triumph, Girardeau's New Favorite, Cuban Queen, Cole's Early, Carolina Bradford, Jordan's Gray, Kleckley Sweet, Scaly Bark, McIver's Sugar, Sweetheart, Jumbo and Ironclad.

All plantings were made in the open ground, after the temperature of the soil had become sufficiently warm to induce rapid germination, the time of planting ranging from March 20 to April 20, according to weather conditions, the average being April 6, every effort being made to secure the earliest possible maturity of the crop when started under these conditions. The method generally pursued in the planting was as follows: A protected situation, with a warm, well-drained soil, known as an "early" soil, is selected; the rows marked off ten feet apart each way, and a hole scooped out at the crossing, which is filled with the Station Compost* (see note below), and well mixed with the soil. The hill is then slightly elevated above the surrounding surface, and the seed planted. Occasionally some difficulty is experienced in getting a stand, owing to heavy rainfall and cool weather, but if plenty of seed is used a sufficient stand can readily be secured under ordinarily unfavorable conditions of this nature.

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*This compost is made as follows: 5 bushels cotton seed, 5 bushels stable manure, 100 pounds acid phosphate, and applied at the rate of 40 bushels per acre for water melons.

The period of ripening has usually been from June 25 to July 10, the average being July 3, with the earlier varieties. In the variety test above referred to, the following have made the best record for earliness of maturity, as in the order named: Cole's Early, Florida Favorite, Girardeau's, Jordan's Gray, Bradford, Ice Cream and Seminole. These are small melons, and are not all productive nor of desirable eating qualities; those making the best record, combining earliness with quality and productiveness, are the following: Cole's Early, Jordan's Gray, Florida Favorite, Bradford and Ice Cream. The medium early melons giving the best average results as to size, quality and productiveness, are as follows: Lone Star, Kolb Gem, Kleckley Sweet, Pride of Georgia, Rattlesnake and Scaly Bark. The later varieties making a good average record in desirable qualities are these: Triumph, Duke Jones, Sweetheart, Jumbo and Cuban Queen.

Perhaps the two most popular melons for general use, one an early melon for home use and local marketing, and the other for shipment to distant markets, are Florida Favorite and Kolb Gem. These varieties were used in the trucking experiments for the past three years, and the following average results secured:

Florida Favorite—Date of ripening, June 28; average weight of melon in pounds, 16; number of melons per acre, 840; average price per hundred, $15.

Kolb Gem—Date of ripening, July 3; average weight of melon in pounds, 24; number of melons per acre, 756; average price per hundred, $18.

Okra.

Variety trials were carried on with okra for a number of years, and for the past three years a small plat has been grown for the purpose of determining whether anything could be expected of it when grown for market, but the results have given no encouragement. The demand for it is very limited, and is readily supplied by the market gardeners.

The following varieties have been tested for a number of years, all with perfect success: Dwarf Density, Dwarf White, Dwarf Green, White Velvet, New South and Tall Growing. The most popular of these is the White Velvet, and it can always be relied on to give perfect satisfaction.

Onions.

In Bulletin No. 81 is mentioned two methods of growing onions, viz: Sowing the seed in the cold-frame and transplanting to the open ground as soon as the plants are of sufficient size; second, planting the "sets" in the field. Both methods have been tried for a number of years, with the results in favor of the former method, or what is popularly known as the "new onion culture."

The best results were secured when the seed was sown in November and given light protection, such as is afforded by the ordinary cold-frame, during the severe weather of January and February, and transplanted to the field early in the spring. When thus grown, we have had them ready for "bunching" by the first of April and by June 1, ready for harvesting. No efforts were made to produce enormous yields, which can readily be accomplished by close planting and heavy fertilization, but the aim has been to produce a crop under average conditions, and with moderate fertilization.

The onion has been grown continuously during the period covered by these experiments, and the general average yield secured for all the years is 200 bushels per acre, the crop being marketed as soon as harvested and cured, and the average prices in the leading markets, from June to September, 75 cents per bushel.

The varieties named below were tested for a number of years, and those making the best average record in productiveness and other desirable qualities, are as follows, named in the order of their merits in these respects: Red Bermuda, White Bermuda, Yellow Globe Danvers, Red Wethersfield, Creole, and Prize Taker. Those not making a good average record are as follows: Early White Queen, Giant Tripoli, White Garganus, Red Garganus, Giant Rocco, White Maggiojola, Globe Spanish, Red Globe, Large White Globe, Early Red Flat, Yellow Dutch, Maderia, Yellow Globe, Giant Rocco Red, Pearl and Silver Skin.

Peas.

The pea is one of the most valuable garden crops, and is also grown quite extensively as an early truck crop, but for this purpose only the "extra early" kinds are planted. From the beginning of these experiments this crop has received careful and thorough attention. In 1896, owing to the lack of moisture at the proper time, a failure of the late-maturing kinds resulted, but the earlier varieties produced a satisfactory yield.

For all the years, the average date of planting has been February 10; the average date of marketable maturity, for the earlier kinds, April 25; of the medium kinds, May 10, and for the late varieties, June 1.

The following varieties were tested during the period named: Station, Extra Early, or First and Best, Alaska, Extra Early Market, Early Washington, Philadelphia Extra Early, Lightning Express, Early Alpha, Tom Thumb, American Wonder, Blue Beauty, Little Gem, Stratagem, Laxton's Long Pod, Telephone, Tall Sugar, Imperial, Duke of Albany, Advancer, Dwarf Sugar, French Canner, Queen, Echo, Petit Pois, Champion of England, Black Marrowfat, White Marrowfat, Paragon, Eugenie, Duke of York, Gradus, Durbans Extra Early, Bishop's Long Pod, Daisy and Kelvedonian.

Of the extra early maturing sorts, the following have made the best average record with respect to yield, quality, etc., named according to their relative merits on these points: First and Best, Extra Early Market, Alaska, Station, Durban's Extra Early, Early Washington, Extra Early Alpha and Tom Thumb.

Of the medium early varieties, the following have given the best average results: Advancer, Blue Beauty, Laxton's Long Pod, Little Gem, Dwarf Sugar; of the late sorts these are the leaders: Telephone, Black Marrowfat, Champion of England, and White Marrowfat. Good average results were also secured from Paragon, Petit Pois, French Canner, Duke of York and Bishop's Long Pod.

Perhaps the most satisfactory early maturing variety is the one known as the First and Best, and in the trucking experiments this was the kind used, the average yield for the past three seasons being 100 bushels per acre, and the average prices received ranging from $1.00 to $1.75 per bushel, the earlier shipments always bringing the highest prices.

Peppers.

Peppers are of comparatively little importance as a truck crop, the demand being limited and easily supplied by the local market gardeners. However, the large salad varieties, when grown and marketed very early, bring fairly good prices.

The following varieties have been thoroughly tested, and can be fully recommended for the various purposes to which they are suited: Celestial (pickling, ornamental); Long Cayenne (sauce); Large Bell (salad); Sweet Spanish (salad); Tabasco (sauce); Chili (sauce); Ruby King (salad); Golden Dawn (salad); Red Cluster (sauce); Birdseye (sauce); Cherry (sauce). The seed is usually planted in the hot-bed in February, and to the field as soon as all danger of killing frost is past.

The Large Bell is the variety usually grown for market purposes, and it should be planted so as to be ready for market during May, when it usually brings a fair price. Our yields from this variety have averaged 120 bushels per acre, and an average price of 75 cents per bushel was obtained.

Radishes.

One of the most profitable early truck crops, when properly grown and marketed, is the radish. The leading essentials in growing this crop may be summarized here: (1) A warm soil and situation; (2) high fertilization, with rapidly available fertilizers; (3) perfect preparation of the soil; (4) sowing the seed at the right time to produce the desired results; (5) using the proper varieties.

Our work with this crop has been as thorough as possible, and for twelve consecutive seasons the following varieties were under test: Early Long Scarlet, Early Frame, Roman Carmine, White Strasburg, Chartier, Round China, China Rose, White Vienna, Half-Long Scarlet, Early Scarlet Turnip, Scarlet Olive, French Breakfast, All Seasons, Golden Globe, Chinese Winter, Black Spanish, California White.

Those scoring the highest averages in point of earliness (the only varieties suitable for market purposes), are as follows, in the order named: French Breakfast, Scarlet Olive, Early Scarlet Turnip and Round China. Those making the highest averages in point of yield and other desirable qualities (suitable for home use and local markets), are as follows: Early Long Scarlet, Chartier, Strasburg and Chinese Winter.

The plantings have always been in the open ground, the average date being February 15, and the period from planting to marketable maturity for the earlier kinds, approximately, 36 days, the earliest varieties, in every instance, being those of the French Breakfast type.

Our experience indicates that ordinarily, in the open ground, April 1 is as early as radishes can be grown for market in this latitude. At this date prices are usually good in the northern markets, ranging from 40 to 60 cents per dozen bunches. The yields per acre are so variable, depending on the variety, the width of row, etc., that an average is not easily reached. As radishes are always tied in bunches, from six to twelve to the bunch, and sold by the dozen, our calculations have been on this basis. For the past three years the average yield has been 1,088 dozen bunches per acre of the French Breakfast variety.*

Squash.

As a truck crop, the squash is of relatively little importance, as its consumption is limited, and the demand easily supplied by the local market gardeners. Yet when shipped to the northern markets early in the season it seldom fails to bring a good price, and principally for this reason it has been the subject of careful attention, both in the variety test and in the trucking experiments.

The following varieties were under test for a period of ten years continuously: Early White Bush, Golden Custard, Summer Crookneck, Perfect Gem, Everbearing, Hubbard, Boston Marrow, Essex Hybrid, Faxon, Fordhook, Pineapple and Turban. The average date of planting for all the years was April 1; and for the early bush varieties the average date of marketable maturity, May 20; of the later varieties, June 20.

The varieties scoring the highest average in point of earliness, yield, quality, etc., are as follows, named in the order of their record: Early White Bush, Golden Custard, Summer Crookneck, Perfect Gem, Pineapple, Everbearing, Boston Marrow. The latter, however, sometimes fails to produce successfully, as our summers are not often favorable to the development of the late varieties. Two crops a year can be grown of the early bush kinds.

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*While this has been the experience of growers in North Louisiana, the Chartier is the only variety grown for commercial purposes in East Louisiana.

In the trucking experiments, the Early White Bush was used exclusively, as it is not only one of the earliest and most productive sorts, but is also the most popular on the market. For the past three seasons it has been planted about the last of March, and brought to marketable maturity between May 15 and 25. The average yield for the three years was 275 bushels per acre, and an average price of 75 cents per bushel received between May 20 and June 10.

Tomatoes.

In many sections of the South the tomato is a very important truck crop, and has been the means of largely increasing the revenue of many sections. All our experiments here demonstrate the fact that it can be grown very profitably in North Louisiana whenever the seasons are favorable; unfavorable seasons occurring on an average of one year out of five during the last fourteen years. By the reference to unfavorable seasons is meant when there is a lack of moisture to the extent of hindering the development of the crop, as in 1896, or when an excess of moisture causes loss from fungus diseases.

The tomato is generally grown for two distinct purposes, viz: for marketing in the fresh state and for canning, the method of culture for each differing radically. In growing for market, the leading essential is earliness of maturity, which can only be accomplished by early sowing of the seed in the hot-bed. The plants must also be pruned and tied to stakes, which is fully explained in Bulletin No. 81. Growing tomatoes for canning is a simpler process; the seed are not necessarily planted until the beginning of warm weather, when they are sown in a bed and transferred to the field directly from the bed, and staking and pruning are not necessary.

The following varieties were under test during the period specified: Atlantic Prize, Acme, Aristocrat, Autocrat, Beauty, Perfection, Stone, Democrat, Ponderosa, Ignotum, Paragon, Favorite, Dwarf Champion, Extra Early Dwarf Red, New York, Waldorf, Prelude, Early Minnesota, King of Earlies, Trophy, Large Yellow, Peach, Honor Bright, Early Richmond, Buckeye State, Rosalind, Bedell's Long Island, Brighton's Best, Early

Hathaway, Crimson Cushion, Magnus, Early Freedom, New Purple Cluster, Sparks Earliana and Chalks Early Jewell. The plantings for the general variety test were made in the hot-bed, the average date being February 1; the plants later being transferred to the cold-frame about the first of March, and subsequently to the field from the 1st to the 15th of April, depending on weather conditions. Taking the average for all the years, the period from seed planting to marketable maturity was 130 days, from February 1 to the 10th of June.

As stated above, earliness of maturity is of prime consideration from the market standpoint, consequently special attention has been given this point, and it has been found that there is on the average from five to ten days difference in the ripening of many of the varieties. The following list, therefore, represents those making the highest average record in point of earliness and other desirable qualities, in the order named: Sparks Earliana, Extra Early Dwarf Red, Ponderosa, King of Earlies. These, however, are valuable chiefly for their earliness. In respect to yield, quality and general merit, the following have made the highest record, in the order named: Acme, Beauty, Stone, Dwarf Champion, Perfection, Trophy, Early Jewell and Crimson Cushion.

On account of our location, experience indicates that there is only a short period of time wherein we can make profitable shipments to the northern markets. This period is between June 15 and July 1. If we bring our tomatoes into market by June 1, we meet with competition from points to the south, and after the first of July, points farther to the north are coming into the market. So by planting our tomatoes so as to bring them on the market during the latter half of June, we can as a rule be assured of securing a fair price.

There seems to be only one type of tomato now generally preferred by the markets, and that is the medium large, smooth, purplish kinds, represented by the Acme, and in our trucking experiments this is the variety used; the average yield for the past three seasons being 100 bushels per acre; the average price received, $2 per bushel; all shipments being made between June 10 and July 1.

On the question of fertilizers, while no systematic experiments have been conducted, experience from year to year emphasises the wisdom of using nitrogenous fertilizers sparingly, as anything that stimulates a rank growth of plant weakens its disease resisting powers, although on these soils it seems necessary to apply nitrogen in some form to nearly all crops to secure profitable yields. For the past several years the following formula has given satisfactory results: 500 pounds cotton seed meal, 300 pounds acid phosphate and 200 pounds kainit.

Turnips.

The turnip occupies an important place in the market garden, both as an early spring vegetable and as a fall and winter crop. It is also a valuable feed crop for live stock during winter and early spring.

The following varieties have been grown for a number of years, in most instances the plantings were made about the first of March for the spring crop, and from the middle of August to the first of September for the fall and winter crop: Early White Flat Dutch, Early Purple Top, Red Top Strap-Leaf, Munich Extra Early, Purple Top Globe, Large White Globe, Cowhorn, White Hanover, White Egg, Snowball, Seventop, Yellow Aberdeen, Amber Globe, Extra Early Milan, Golden Ball, White Norfolk, Callaway, Scarlet Kashmyr, Yellow Swede, Improved Purple Top Rutabagas and 'Bon-Air'' Rutabagas.

As with other vegetables, when grown as a market crop, the matter of early maturity is very important, and according to our records, many of the varieties reach marketable maturity from one to three weeks earlier than others when grown under high culture, and the list given above, covers a wide range of season, including the earliest, the medium and the late.

Those making the highest average on the points of yield, quality and general merit, are as follows: The early kinds—Extra Early Milan, Munich Extra Early, Early White Flat Dutch. The medium kinds—Early Purple Top, Red Top Strap-Leaf, Purple Top Globe, Cowhorn, White Egg. The late kinds—Golden Ball, Large White Globe, Callaway.

The late varieties are usually more productive than the early ones, but the latter are the most profitable for market purposes.

In regard to the rutabagas, this vegetable deserves more attention on the part of the farmers than it now receives. It is uninjured by our winters, and during the early spring there is a good demand for it on the local markets. For the past several years rutabagas have been shipped in here from other points, and sell readily at from 4 to 7 cents per pound. The variety known as the "Bon-Air," which is an improved strain of the Purple Top, has given excellent results. They should be drilled about the first of September, in rows about eighteen inches apart, and the soil made very rich with stable manure.

In addition to the foregoing, the following miscellaneous vegetables were grown.

Artichoke.

Several varieties of this vegetable were grown for three years in succession, and the plant does splendidly on these soils. It is not, however, a popular vegetable in this section, and its further culture was abandoned.

Asparagus.

This vegetable, like the above, is practically unknown in the gardens of North Louisiana. A small bed of it has been grown for a number of years, and an effort is now being made to acquaint our people with its merits. An half acre plat set out one year ago, has made a very promising growth the past season, and gives promise of a profitable yield next year.

Cauliflower.

Repeated efforts have been made to grow this vegetable, but without any decided success. A partial success was achieved for several years by sowing the seed in November, carrying them through the winter in the cold-frame, and transplanting to the field the latter part of February. But it was finally decided that whatever success might be achieved would be at the expense of any probable or possible profit, from the market standpoint, and further attempts were abandoned. It is believed, however, that in specially favored localities its culture could be made a success. On the Station grounds, however, it will not succeed without special efforts.

Carrots.

This vegetable has been grown here with the same ease and success as the turnip, but it is unpopular in this section, and no special effort was made with it.

Kale or Borecole.

Grows here as well as the collard; should be planted in the early spring, cultivated during the summer, and will make excellent "greens" during fall and winter. Several varieties were tested, the best of which are Green Curled Scotch, Tall Scotch and the Striped or Variegated.

Kohlrabi.

This excellent vegetable is now better known and appreciated in the gardens of North Louisiana than a few years ago, due to the fact of visitors having observed it growing in the garden of the Station. It should be planted in March in the open ground, and thinned out to four inches apart. Several varieties were tried, the best of which is the Early White Vienna.

Leeks.

This vegetable is used mostly for flavoring and pickling purposes. It grows here as well as the onion, and really stands the summers better. It should be planted in the early spring months, and will be ready for use during the fall and winter. The most desirable variety among those tried was the Large Flag

Mustard.

The mustard is a very easy and inexpensive vegetable to grow, and is always in demand as early "greens" during spring and fall. It can be grown here the year round. The seed are very cheap and it now has a value to the gardener hitherto unobserved, and that is as a "catch" crop for the harlequin bug. It is perhaps of more value in this respect than as a garden vegetable. Of the many varieties grown, the Southern Curled and the Chinese Large Leaved are the best.

Parsley.

This vegetable has been grown here successfully, but is very rarely found in the gardens of this section. It is used for garnishing purposes exclusively; should be sown in March and given good culture during the summer. The most desirable varieties tested here were the Plain, Moss Curled and Fern-Leaved.

Spinach.

This vegetable is largely grown in certain sections of the South for shipping to the northern markets during the early spring months. It is rarely found, however, in the average country garden. It was very successfully grown here for a number of years, and several varieties were tested, the most desirable of which are Round-Leaved Flanders and Curled Savoy.

Irish Potatoes.

Work with Irish potatoes was first begun in 1889, including variety trials, fertilizer and physiological experiments. These experiments were quite elaborate, and were carried on for three seasons in succession, yielding some very valuable results, which were published in the Annual Report of the Station for the years 1889, 1890 and 1891.

Upon the completion of these experiments, the work embraced for several years, general variety and fertilizer tests, and incidentally, considerable work along commercial lines was performed, for the purpose of putting to a practical test the results secured. And latterly, extensive tests were made with home-grown versus bought seed, the results of which are reported on in Bulletin No. 68. During recent years, and up to the present season, all our efforts have been along the line of investigating the problems of commercial growing.

Varieties.

With us there are two phases of the variety question, according to the purpose for which they are grown. When the intention is to plant for shipment to the northern markets, it is necessary to use a very early maturing variety, as the experience of the past few years emphasizes very strongly the fact that in order to obtain profitable prices our potatoes must be marketed not later than June 1. Consequently the most important problem to be solved in this connection is that of early production of the crop. We have tested upwards of 250 varieties, but this large number was only grown for two seasons, as only a small per cent of these proved to be worthy of continued trial.

Of these, the following made the most satisfactory records, and were selected for an exhaustive test:

	Average Yield. Bushels.	Average date of Marketable Maturity.
Extra Early Vermont	85	May 30
Early Rose	92	June 2
Bliss Triumph	90	May 25
Boston Peerless	125	June 10
Beauty of Hebron	97	June 6
Early Ohio	112	May 30
Burbank	120	June 15
White Elephant	95	June 15
Rural New Yorker No. 2	80	June 15
Crown Jewell	97	June 5
Rochester Rose	110	June 5

There is much in the above table for encouragement on the point of early maturity taken in connection with average yield, but in growing potatoes for the northern markets, the popular demands of the markets cannot be ignored, and in this connection the Bliss Triumph is practically the only potato grown in the South for early shipment to the northern markets, and being the potato the markets want, it is the potato to grow. As will be seen from the above table, this (the Triumph) made the highest average in early maturity, but a comparatively low average in yield. The next most desirable potato on the list for early market purposes is the Early Ohio. Those most suitable for general purposes are Early Rose, Boston Peerless, Crown Jewell and Rochester Rose. The late maturing varieties seldom make a satisfactory yield in this section, as they are frequently cut short by dry weather in June.

Time of Planting.

As above mentioned, the date of marketable maturity from the standpoint of the northern markets is an important matter, and consequently the date of planting is gauged accordingly, regardless of prevailing weather conditions, unless they are such as to prohibit planting at the desired time. This is only applicable, however, where the object is planting for shipment to the northern markets.

The following table gives the date of planting and the number of days to marketable maturity for fifteen years:

Year.	Date of Planting.	Number Days to Marketable Maturity. Days.
1892	Feb. 12	107
1893	Feb. 17	110
1894	Mch. 3	105
1895	Feb. 23	110
1896	Mch. 14	100
1897	Feb. 16	104
1898	Feb. 9	106
1899	Feb. 28	104
1900	Feb. 10	100
1901	Mch. 8	100
1902	Mch. 1	106
1903	Feb. 24	108
1904	Feb. 16	104
1905	Mch. 1	104
1906	Feb. 10	104
Average	Feb. 14	105

A study of the above table shows that the range in the date of planting is from February 9 to March 23, the average being February 14. Different agencies caused this variation in planting; once or twice being due to delay in getting seed; freezing weather, however, is the principal cause.

The average number of days from planting to marketable maturity, as will be seen, is 105. By adding the number of days to the date of planting the date of marketable maturity can be ascertained. These averages are based on the record of the earliest variety tested, the Triumph.

These results establish quite conclusively that the period from May 25 to June 5 is the time when the potato crop in this section can be expected to be ready for market. Therefore, the prevailing market prices at this period have an important bearing on the result.

We give below sample quotations from two of the leading markets.

Date of Quotations.	Market.	Prices Per Bush.
May 26	Chicago	$1 25
May 30	Chicago	1 40
June 5	Chicago	1 25
May 26	Cincinnati	1 25
May 30	Cincinnati	1 50
June 5	Cincinnati	1 15

These prices are for No. 1 stock, Red Triumph, and are the average for three years. The problem, however, of securing market prices is one that the individual grower and shipper must solve for himself, as so much depends on the quality of the stock, the grading, packing and transportation facilities. It may safely be assumed that where due regard is had for these matters, and the potatoes are placed on the market at the proper time, a fairly good profit could be made.

The question of growing potatoes for home consumption is simpler and less exacting than commercial growing, and the planting can be deferred until the most opportune time, which in this latitude is usually about the first of March. Any all-around good variety is suitable for this purpose, but the Triumph is now used more extensively than any other, chiefly on account of its earliness and good table qualities.

But it is advisable to plant more than one variety in order to have a succession lasting throughout the greater part of the season. Our experience proves that the best varieties to follow the Triumph are either the Early Ohio or Early Rose, and the Boston Peerless.

The Second Crop.

Concerning the growing of the "second" or "fall" crop of Irish potatoes in the South for the purpose of using the tubers for the succeeding spring crop, four things are now definitely settled, and need not be remarked on here. (1) Its practicability; (2) its economic importance from the standpoint of paying high prices for the northern seed; (3) its successful use for this purpose; (4) the best methods of growing the crop.

There are one or two important points, however, that must be emphasized: (1) The selection of the seed must be made when the spring crop is harvested, experience proving that the medium to small tubers are to be preferred, and that they should not be cut before planting, but planted whole; (2) the seed must be sprouted before planting to insure a crop, which is best accomplished by spreading the potatoes out in a cool, dark room, and covering them completely with straw or saw dust. This method, however, usually requires about four weeks to get the "eyes" well started, and when it is necessary to sprout them quickly, spread them out evenly on the ground under the shade of a tree and cover with saw dust or any convenient material and keep the bed moist, but not wet; (3) the soil must be in state of thorough preparation when the potatoes are planted, which should be done at the most favorable opportunity, preferably just before a rain.

Depth of Planting.

This is an important point, especially if dry weather follows the planting. Experiments conducted along this line at this Station indicate that four inches is about the proper depth under ordinary conditions.

Time of Planting.

If the tubers are well sprouted the middle of August is early enough to plant. We have made plantings at different dates, from the first of July to the first of September, and find that the earlier plantings do not, as a rule, give the best results.

Yields per Acre.

We have been working with the fall crop at this Station for the past nine years, and during this time five successful crops have been grown, and four partial ones. The average yield has been 56 bushels per acre, the highest yield being 125 bushels.

Sweet Potatoes.

The sweet potato has been treated so thoroughly in former bulletins and reports of these Stations, that little remains to be said here. It is a crop easily grown and adapted to a wide range of uses.

The only variety now generally esteemed and widely planted in this section is the Vineless or Bunch Yam. Owing to its ease of culture, productiveness and excellent table qualities, it is in great favor with the farmers of this section. This variety has been grown for nine consecutive years at this Station, and has given an average yield of 230 bushels per acre.

The Pumpkin Yam is also highly esteemed by many for its good table qualities, and early maturity, but is a comparatively light yielder, having made an average yield of only 175 bushels per acre.

Of the many varieties adapted chiefly for stock feeding purposes, the Southern Red Yam and the Queen Yam are the most popular, the former making an average yield of 250 bushels, and the latter 237. These varieties do not rank high for table use.

Fertilizer Experiments.

The following experiments in fertilizers were conducted for three successive seasons, the average yield being given:

No. Exp.	Formula.	Yield per Acre. Bushels.
No. 1.	100 pounds kainit	240
No. 2.	200 pounds acid phosphate	285
No. 3.	300 pounds cotton seed meal	244
No. 4.	100 pounds kainit 200 pounds acid phosphate	276
No. 5.	100 pounds kainit 300 pounds cotton seed meal	260
No. 6.	200 pounds acid phosphate 300 pounds cotton seed meal	320
No. 7.	No fertilizer used	255
No. 8.	100 pounds kainit 200 pounds phosphate 300 pounds cotton meal	295

A study of the above results shows that the fertilizer in Nos. 1 and 3 were applied at a loss when used singly, as they produced less than when no fertilizer was used, as in No. 7, but when combined, gave a slightly increased yield; and also where a nitrogenous fertilizer was used singly, as in No. 3, the yield of tubers was smaller than when combined with phosphate, as in No. 6, due, doubtless, to an excessive growth of vine induced by the nitrogen.

The most profitable yield from any single application was from No. 2, where acid phosphate is used, and as will be seen, this holds good throughout all the experiments, indicating that phosphoric acid is the element most needed by potatoes on these soils.

RESULTS WITH FRUITS.

Strawberries.

One of the fruit crops to which North Louisiana is especially adapted is the strawberry. For fourteen years it has been cultivated here continuously, and no serious drawbacks to its culture, outside of occasional protracted droughts during summer and fall, have been encountered. The fear of drouth, however, need not deter any one from attempting their culture, as we have repeatedly demonstrated that by giving thorough and clean culture, the plants will survive a prolonged drouth, as was proven in 1896, the most severe drouth ever experienced in this section.

Blooming sometimes begins very early, occasionally as early as the 15th of February, and of course, if unprotected, these blooms are killed by frost; where only small plats are grown, the blooms are easily protected by the use of pine straw.

Our first berries are usually ripe, from the extra early kinds, by the 10th of April, and we have sold our first berries on the 20th of April, the main crop coming in from this date on to the middle of May.

The method of growing these berries has been what is known as the matted-row system. The plants are set eighteen inches apart in four-foot rows, and the runners allowed to fill the row completely, with the exception of a space between the rows where the cultivator is run.

Varieties.

From 1892 to 1905, upwards of 150 varieties were tested. many of them being on trial for eight years continuously, and a few as long as twelve years. The greater part of these varieties are not found on the market now, and consequently a report on them here would be of no interest. A great mass of data was secured from these variety trials, which, while valuable to the experimenter, would be of no attraction to the reader; and it is deemed best to include in this report only those varieties making the highest general averages, and that are at present offered to the public. These are included in the table below. All those not making an average yield of more than 1,000 quarts per acre are excluded.

Variety.	On Trial. Years.	Average Productiveness. Scale, Zero to Ten.	Average Date of Ripening.
Aroma	6	6	April 20
Barton's Eclipse	6	8	April 20
Bismark	6	8	April 20
Beder Wood	6	5	April 15
Bubach	8	6	April 25
Crescent	10	6	April 18
Cloud	6	5	April 15
Clyde	6	5	April 15
Darling	4	6	April 15
Dunlap's	4	7	April 18
Earliest	5	7	April 15
Excelsior	8	5	April 12
Gandy	10	5	April 25
Glenn Mary	6	7	April 20
Haverland	12	8	April 30
Hoffman	12	4	April 15
Howell	6	7	April 25
Klondyke	4	8	April 20
Lady Thompson	7	7	April 15
Marshall	4	7	April 22
Margaret	6	8	April 22
Mitchell	6	5	April 15
Murray's Extra Early	6	4	April 12
Nick Ohmer	4	7	April 18
Parker Earl	6	6	April 20
Sample	6	5	April 20
Sharpless	8	7	April 20
Staples	6	5	April 18
Tenn. Prolific	6	6	April 20
Van Deman	7	6	April 20
Warfield	10	5	April 25

The above list comprises most of the leading varieties in cultivation at present, but the matter of making recommendations is always more or less an uncertainty, as the local conditions and treatment determine very largely, if not wholly, the merits of a given variety. Besides, a large number of new varieties are introduced annually, and old ones superseded, while improvement is constantly being made. No one variety ever enjoys a wide range of popularity, each berry-growing section having its favorite. A few years ago the Lady Thompson was the only variety grown in the berry section of Southeast Louisiana, while at present the Klondyke is grown exclusively. Both these berries do splendidly in this section, and besides these, for home use and local market, might be added, Barton's Eclipse, Haverland, Margaret, Bismark and Excelsior.

Fertilizer Experiments.

In order to determine the manurial requirements of the strawberry on these soils, a series of experiments was begun two years ago on one-half acre of ground, using the Lady Thompson. Last season the crop was too light to give any decided results, but the season just passed furnished a large crop, and the results are given herewith, although the experiments have not been carried to a definite conclusion; but as the past season's crop was an average one, it is believed the results strongly indicate the lines along which definite conclusions will be reached. The berries were ripening April 15, and the first shipment was made April 23. The last picking was made on May 23. The berries were sold on the local market at an average price of 40 cents per gallon, net.

No. Exp.	Formula.	No. Gallons per Acre.
1.	500 pounds cotton seed meal	572
2.	1,000 pounds cotton seed meal	748
3.	1,500 pounds cotton seed meal	803
4.	250 pounds acid phosphate	407
5.	500 pounds acid phosphate	407
6.	750 pounds acid phosphate	407
7.	250 pounds kainit	341
8.	500 pounds kainit	407
9.	750 pounds kainit	407
10.	No fertilizer used	385
11.	500 pounds cotton seed meal, 250 pounds acid phosphate	593
12.	500 pounds cotton seed meal, 500 pounds acid phosphate	627

13.	500 pounds cotton seed meal, 750 pounds acid phosphate	682
14.	500 pounds cotton seed meal, 250 pounds kainit	792
15.	500 pounds cotton seed meal, 500 pounds kainit	792
16.	500 pounds cotton seed meal, 750 pounds kainit	792
17.	1,000 pounds cotton seed meal, 500 pounds acid phosphate	858
18.	1,000 pounds cotton seed meal, 750 pounds acid phosphate	968
19.	1,500 pounds cotton seed meal, 1,000 pounds acid phosphate	902
20.	500 pounds acid phosphate, 250 pounds kainit	526
21.	1,000 pounds acid phosphate, 250 pounds kainit	660
22.	1,500 pounds cotton seed meal, 250 pounds kainit	924

The guaranteed analysis of the above fertilizers is as follows: Cotton seed meal, 7 per cent nitrogen; acid phosphate, 14 per cent phosphoric acid; kainit, 12 per cent potash. It is very plain that nitrogen is required to produce a profitable yield, which is best illustrated by a comparison between No. 3, where 1,500 pounds of cotton seed meal is used, representing an application of 105 pounds of nitrogen per acre, and No. 10, the blank. Here the percentage of gain is 108 per cent in favor of the fertilizer. It will be further noticed the per cent of gain from the use of phosphoric acid and potash is very small, approximately only 10 per cent, and that the difference between the yields from these two elements is insignificant. The question, then, of the value of these two elements arises. The nitrogen plats produced a rank growth of vine and an abundance of large fruits, but the three important elements, texture, color and flavor were lacking. The phosphoric acid supplied both color and flavor from 25 to 40 per cent, and the potash supplied texture and firmness accordingly, although neither of these elements added appreciably to the size and quantity of fruit.

Peaches.

From the beginning of these experiments the peach has been the subject of careful study and investigation, although the question of its adaptability to our conditions of soil and climate was of secondary consideration so far as it related to our work, as it was generally known that satisfactory crops of peaches had been grown in the home orchards of North Louisiana from the earliest settling of the country, most of which were of seedling origin, and only a few of the improved commercial varieties had been tried.

The work, therefore, proceeded along other lines, principally as follows: (1) Educational work along the line of the best methods of peach culture; (2) testing the general merits of the many varieties offered to the public, including the old standard sorts and the many new introductions placed on the market from time to time; (3) determining the chief difficulties and drawbacks to successful peach culture in this section that might be encountered from time to time, and the best means of overcoming them; (4) demonstration work in commercial peach culture.

The greater part of the results obtained have already been published in various publications of the Louisiana Experiment Stations, the State Board of Agriculture and the State Horticultural Society.

In Bulletin No. 81 of the Louisiana Experiment Stations, very complete data secured from a large number of varieties is published, but the results are for one year only, which fact the reader should consider. The general recommendations made therein, however, are for the most part based on several years' experience, and up to the present no alteration of that list has been found necessary.

From the general variety trials, in which 150 varieties were tested, beginning in 1889 and extending up to the present, the following table gives the summarized results of thirty-two of the most successful varieties, showing the number of years each variety was under test, the number of successful crops obtained, the average date of ripening and the average quality of the fruit for the number of years each variety was on trial:

Variety.	No. Years. on Trial.	No. Successful Crops.	Average Date of Ripening.	Average in Quality, 1 to 10.
Sidney Albert	7	3	July 15	6
Alexander	14	4	May 20	4
Amelia	14	3	June 25	6
Berenice	8	5	July 15	8
Berckman's	6	3	July 15	7
Chinese Cling	12	4	July 20	4
Columbia	12	6	July 25	5
Crawford Early	12	5	June 25	6
Crawford Late	12	3	July 25	7
Crosby	6	2	July 25	5
Early Beatrice	10	4	June 1	6
Early Rivers	12	5	June 10	7
Elberta	12	6	July 5	8
Fleitas St. John	10	3	June 25	7
Newington Cling	8	4	July 10	8
Old Mixon Free	10	4	July 20	6
Oriole	12	8	July 25	7
Pallas	12	8	June 24	6
Mamie Ross	12	6	June 5	5
Sneed	6	2	May 20	3
Thurber	12	6	June 30	8
Alton	6	2	June 25	5
Bokara No. 3	6	3	June 30	6
Carman	6	2	June 25	8
Carpenter	6	3	July 20	7
Early Tillotson	6	3	June 25	7
Galveston	6	3	June 25	8
Greensboro	6	3	June 5	5
Mountain Rose	6	3	July 30	8
Onderdonk	6	2	July 20	6
Smock Free	6	2	July 30	5
Waddell	6	3	June 25	7

*The life of the average tree has been disappointingly short. A very considerable number of trees has been destroyed by root gall—(nematode worms).

Results of Varieties in General.

As previously stated, the above table is a summary of the most successful varieties tested from 1889 to 1906; some of the varieties, as will be seen, were on trial fourteen years; others only six; the average being eight years, and the average number of successful crops being four, or a successful crop every two years on the average. The partial crops obtained are not taken into consideration. A total failure of the crop has been seldom; during the period covered by this report, only three total failures are recorded, viz: 1892, 1895 and 1899, each failure being due to killing frost during the blooming period.

The first orchard was set out in the winter of 1888, but was incomplete in the list of representative varieties, and also some of the races or strains of peaches were not represented. In 1892 further additions were made, and in the fall of 1899 a general and comprehensive variety test was begun, embracing many representative varieties of the five recognized strains of the peach, viz: The Persian, the North China, the Spanish, the South China or Honey, and the Peento.

As this is a matter of considerable importance to the peach growers in this section, the general results of these different races secured on our grounds, will probably not be out of place.

The Persian—Representative varieties: Early Crawford, Smock Free and Crosby. Average date of bloom, March 10 to 20. Somewhat tender in bloom, and inclined to be short-lived. Fruit usually good whenever they bear.

North China—Representative varieties: Mamie Ross, Elberta, General Lee and Thurber. Average date of blooming, March 1 to 15. Very hardy and withstands considerable cold. Tree healthy and rapid growing. The most dependable strain for this section.

The Spanish—Representative varieties: Indian Blood, Everbearing and Columbia. This, as a class, has not given satisfactory results, although there are several acclimated seedlings of this strain that give axcellent results.

South China or Honey—Representative varieties: Honey, Pallas and Florida Gem. Average date of blooming, February 15 to 25. As a rule these are too tender and always bloom too early to be reliable in this latitude.

Peento—Representative varieties: Angel and Bidwell Early. Average date of blooming, January 15 to 25. These seldom fruit in this latitude, although we have secured two partial crops from the Angel and Bidwell Early, and the fruit was of good quality.

Very valuable results were secured from this last orchard, the one set in 1899, as not only the question of the adaptability of the different races to this section has been settled, but in nearly every instance the results and deductions of our previous trials were confirmed, and we are now enabled to present a very complete list of varieties adapted to this section, and suitable for all practical purposes. This list comprises the one given in the table above.

In order to present a complete and convenient summary of the results of the variety work, the following extract is taken from a paper read by the writer before the State Horticultural Society in January, 1905:

"For general purposes varieties may be classified as follows: (1) Extra Early Varieties; (2) Early Varieties; (3) Medium Early Varieties; (4) Mid-Season Varieties; (5) Medium Late Varieties; (6) Late Varieties.

"Of the extra early class, ripening from May 15 to 20, the Sneed has given good results, although the fruit is very soft and will not carry to distant markets. The chief value of this variety is its extreme earliness.

"Of the early class, ripening from May 20 to June 5, Alexander, Triumph and Greensboro head the list so far. They are meritorious varieties in their season. The first is a red, the second a yellow and the third a white peach.

"Of the medium early class, ripening from June 5 to 25, Mamie Ross, Carman, Early Tillotson, Early Crawford, St. John and Waddell have given the best average results, and are recognized as standard varieties.

"Of the mid-season class, ripening from June 25 to August 1, Mountain Rose, Lady Ingold, Berckman's, Thurber, Elberta, General Lee, Newington Cling, Carpenter, Old Mixon Free, Berenice, Georgia Cling, Oriole and Albert Sidney have given the best average results in the order named.

"In the medium late class, ripening from August 1 to 25, Smock Free, Wonderful, Plant Cling and Juno have given the best results in the order named.

"In the late class, from September 1 on to the close of the season, the list of dependable varieties is very limited. So far, Deming's September and Stinson's October are the only varieties that have given any encouraging results."

The Effect of Frost on Peach Blossoms.

It is generally believed that the most serious drawback to the successful culture of the peach in North Louisiana is the danger of the blossoms being destroyed by late frost, but experience and observation led to the belief that what is considered a "killing" frost does not always destroy the crop, and in order to secure definite information on the subject, careful observations were made and records kept for a number of years on the appearance of frost after blooming time, its effect on the blossoms and the resulting crop, and the results are given in the table below, using four of the leading and most successful varieties.

Year.	Date of Full Bloom.	Date of Last Killing Frost.	Per Cent of Blooms Killed.	Per Cent of Full Crop.
Variety—Mamie Ross—				
1902	Mch. 16	Mch. 25	30	25
1903	Mch. 10	Mch. 24	60	20
1904	Mch. 1	Mch. 15	10	80
1905	Mch. 10	Mch. 12	20	20
1906	Mch. 15	Mch. 21	20	75
Variety—Elberta—				
1902	Mch. 14	Mch. 25	35	20
1903	Mch. 10	Mch. 24	65	15
1904	Mch. 3	Mch. 15	15	60
1905	Mch. 12	Mch. 12	30	15
1906	Mch. 10	Mch. 21	25	60
Variety—Berckman's—				
1902	Mch. 16	Mch. 25	20	40
1903	Mch. 10	Mch. 24	30	35
1904	Mch. 6	Mch. 15	10	95
1905	Mch. 16	Mch. 12	20	50
1906	Mch. 18	Mch. 21	20	70
Variety—Waddell—				
1902	Mch. 13	Mch. 25	15	40
1903	Mch. 8	Mch. 24	25	70
1904	Mch. 3	Mch. 15	10	60
1905	Mch. 14	Mch. 12	20	40
1906	Mch. 8	Mch. 21	20	65

The extent of frost injury depends on more than one condition; usually the stage of the blossom is the most important factor, while the atmospheric condition is sometimes an important factor in deciding the result. If frost occurs immediately after or during the period of full bloom, prior to the flowers being fertilized by the pollen, the results are usually disastrous; also if severe rain and wind storms prevail during this period, the results are more injurious than from frost. After the flowers have been fertilized, and before the calyx drops, the fruit is capable of withstanding considerable frost, as in March of the present year, when the temperature reached 28 above zero, yet, on the average, only 20 per cent of the crop was destroyed. It is very seldom that a killing frost occurs after the calyx has fallen and exposed the young fruit, which is usually about the first of April. The above results also indicate considerable difference in the hardiness of the varieties as regards frost injury; also that the late bloomers are more apt to be injured than those blooming earlier. Our experience proves decidedly that varieties blooming from the 1st to the 10th of March usually suffer less injury than those blooming between the 15th and the 25th of March.

Apples.

As indicated in previous reports, no satisfactory results have been secured from the plantings of apples of northern origin. A large number of varieties have been tested, and while no difficulty has been experienced in getting satisfactory growth of tree and abundant fruitfulness, yet the trees are short-lived, owing, doubtless, to uncongenial climate, and the fruit is subject to various fungus diseases, especially bitter rot. Of course, it has been satisfactorily demonstrated that these diseases can be effectively controlled by spraying, but as we have always had our hands full of other important lines of work, very little opportunity has been offered to test the effectiveness and economy of spraying in this latitude, at least so far as the apple is concerned.

What is said here in regard to apples applies to those that were originated and developed in northern and western climates. We have been able to obtain only a few apples for testing that were known to be of southern origin, especially fall and winter varieties.

A few of the early and mid-summer varieties have given uniformly good results, not only in our orchard, but throughout this section generally. These varieties are Astrachan, May Pippin, Early Harvest, Red June and Rhodes' Orange. It is obvious that to succeed with apples in North Louisiana they must be adapted to the climatic conditions, and we are now making preparations to begin exhaustive work in the line of developing apples peculiar to our conditions.

Pears.

Extensive tests conducted with a large number of varieties of pears for the past ten years, including the American, European and Oriental classes, have developed some very valuable results, but the number of dependable varieties is small, and mostly limited to the Oriental class. No decidedly promising results have been secured from the American and European classes.

The only serious difficulty encountered in their culture is the bacterial blight (Micrococus amylovorus); but by persistent efforts it has been successfully held within control, and at times completely eradicated, but as we could not always secure efficient co-operation with our neighbors in keeping the blight out of their orchards, ours has repeatedly been infected. Close observation, extending over a number of years, and under varying conditions, establishes conclusively the fact that some varieties are less susceptible to blight than others, or at least, they do not suffer serious injury when attacked.

The most successful varieties, and those showing the least tendency to blight, are as follows, named in the order of their respective records in this respect: Kieffer, Garber, Leconte and Smith's Hybrid. The Kieffer is the most popular of these varieties, and is largely planted throughout this section. This variety was formerly thought to be suitable only for culinary purposes, but it is now considered a good market fruit; it also has fairly good dessert qualities when properly ripened.

The Kieffer ripens here during the first half of October; the Garber in September, the Leconte in August and Smith's Hybrid in July.

Other varieties that have made a promising record, and are worthy of further trial, are Magnolia, Bartlett, Howell's, Clapp's and Koonce.

Plums.

The adaptability to these soils, of the numerous recognized standard varieties of plums now on the market has been exhaustively tested for the past ten years, and while no flattering results were secured, sufficient information has been developed to serve as an intelligent guide in future work. Of the many varieties tested, only a few have shown indications of being adapted to local conditions. These include varieties of both the American and Japanese classes.

For four successive seasons the following produced excellent results, and showed indications of adaptability: Wild Goose, Cumberland, Miner, Robinson, Kanawha and Newman.

For three seasons excellent results were secured from the following: Milton, Poole's Pride and Abundance.

For two seasons the following produced good crops: Chabot, Red June, Wickson, Kerr, Ogon and Kelsey.

There are native wild plums found in this section that sometimes produce larger and better fruit than some of the cultivated varieties we have tested, and one of our future efforts will be to improve these by cultivation and crossing with the best of the cultivated varieties.

One difficulty that has stood in the way of our work with plums is that an altogether suitable soil for plums on the Station grounds has not been found, and it has been necessary to start a new orchard in a different location repeatedly.

One-half mile from the Station grounds is a small orchard of the Abundance variety that we have had under observation for several years, and it annually produces heavy crops of luscious fruit, some of which was shipped to the Cincinnati market and sold for $2 per crate. The trees are in excellent condition and are now ten years old.

Grapes.

In the winter of 1888 a vineyard was set out consisting of 56 varieties of grapes, very few of which were other than northern origin, and the result was that fully 80 per cent of them proved unsuccessful. However, they were very carefully cultivated for a number of years, and the effort was not without some good results.

For six years the following produced good crops: Niagara, Brighton and Norton. For four years these did well: Concord, Delaware, Moore's Early, Lenoir, Salem and Agawam.

The most important lesson taught by these results is that to have grapes in this climate we must develop them from our native material. Our future efforts with grapes will be in this direction.

Figs.

The following varieties of figs have been thoroughly tested: Madeleine, Black Ischia, Green Ischia, White Marseilles, Celeste, Brown Turkey, Blue Genoa, Angelique, Brunswick and Lemon.

The difference in the hardiness of these varieties has been very marked. However, all of them are capable of withstanding our average winters, but when an unusually severe winter occurs, such as that of 1899, many of them are killed to the ground, but come out again the following spring. The following, however, are rarely killed to any extent and can be depended on to produce annually: Celeste, Brown Turkey and Brunswick. The others in the list are too tender for general planting.

CANNING FRUITS AND VEGETABLES.

The preliminary report on home canning published in Bulletin No. 81, has been the means of stimulating extensive inquiry and interest in this line of work, and as the present edition of that Bulletin will soon be exhausted, it is deemed advisable to insert a few general remarks on the subject in this report.

In the beginning of the Station's work in this line, some doubts may have been entertained as to the success of home or farm canning, and its permanent establishment as an adjunct to diversified farming, although its economic value and importance was never questioned. Its success has been fully demonstrated, not only by the Station, but a large number of farmers are putting it to practical use, both for home consumption and for market, and their goods are meeting with ready sale and elicit favorable comment.

The Advantages of Home Canning.

Undoubtedly home canning is relatively of greater importance to the truck grower than to the general farmer, as the latter grows large areas of the perishable vegetables and fruits, which means that there is nearly always more or less loss, unless he is equipped with a canning outfit on the ground, so that all the surplus can be turned into a salable commodity and placed on the market whenever prices justify. Thus the surplus that would otherwise be lost, if properly preserved and marketed, should be sufficient to pay the expenses of cultivation, etc. On the other hand, the average farmer is thus enabled to utilize to the best advantage all the surplus fruits and vegetables that are incidentally produced on the farm, by converting them into a wholesome food product, adding considerably to the variety of table fare, and extending their use from season to season.

The Available Products.

When we look into the question it is surprising to find what a great variety of products there are available for canning, covering nearly half of the season. This is particularly true from the standpoint of canning simply for home consumption, as there are a number of fruits and vegetables that have a very limited sale on the general market, such as squash, okra and plums; and in canning for market it is best to confine one's operations to those fruits and vegetables most generally found on the market, such as tomatoes, peaches, pears, etc. For home use and for marketing only incidentally the following are the principal products: Asparagus, string beans, sweet corn, okra, squash, tomatoes, peas, beets, sweet potatoes, peaches, pears, apples, plums, cherries, blackberries, huckle berries, raspberries, strawberries, figs and grapes. Of course, any and all of these products are found on the market to some extent, but in canning for market the most profit will be made from the leading products, such as tomatoes, peaches, etc. In addition to fruits and vegetables the canning of cane syrup and putting it on the market in an attractive form affords an excellent opportunity for increasing the revenue of the farm, and incidentally to building up a profitable industry.

General Information.

Under this head will be included only those fruits and vegetables extensively used for canning and generally found on the markets. If the object is to place the goods on the market, the essential point to consider is that they are to compete with the standard brands of canned goods, and in order to do this they must have some special points of superiority to recommend them. A good plan is to study the packing and quality of the standard brands, and if possible, make improvement on both the quality and quantity of the commercial goods; that is, the quality should be as near perfect and uniform as possible, and every can should be well filled.

Tomatoes.

The tomato is one of the easiest crops to grow, and is more largely grown for canning than any other vegetable. The varieties best suited for canning are the Acme, Beauty and Stone. The average yield under favorable conditions is 200 bushels per acre; one bushel, on the average, fills 24 two-pound cans, or at the rate of 4,800 per acre, or 400 dozen. At this date (October, 1906), the average wholesale price is 95 cents per dozen, for the best grade, making the gross proceeds from an acre worth $380. The average cost of putting a dozen cans of tomatoes on the market, including the material, the labor, the cans, shipping cases and labels, is figured at 50 cents, or $200 per acre, leaving a net profit of $180. These figures are the average estimates of the large canning factories. As a matter of fact, home canning is done cheaper than this. Tomatoes should be exhausted ten minutes and processed, or cooked, twenty minutes, and the work must be accurate and thorough if good results are expected. We have heard some complaint of loss from ''swelling'' after the goods were packed and stored away. We are confident, from experience, that losses from this source are always due to imperfect work. Last year we put up 1,000 cans of tomatoes, and lost only 1 per cent, or ten cans, which was traceable to defective cans. This past season we put up 400 cans and did not lose a single one.

String Beans.

The green, round-podded beans, such as the Valentine, are best for canning; they are put up in three-pound cans. It is neither necessary nor hardly advisable to cook them in any way before canning, as much of the flavor is lost if cooked in open vessels. A brine solution to suit individual taste should be used. Beans are exhausted in twenty minutes and processed in forty minutes. One bushel will put up 24 three-pound cans.

Sweet Corn.

For commercial purposes, corn cannot be successfully packed on what is known as the ''open process'' kettle, as it requires a higher and longer sustained pressure to insure perfect sterilization than most products, unless some kind of preservative is used, which practice should be discouraged. We have had perfect success in canning corn on the small outfits used by the Station, without using any preservatives whatever. But it is only practicable for home use, as five hours continuous boiling is necessary in order to thoroughly sterilize the contents.

Sweet Potatoes.

While the canned sweet potato is not yet a popular commodity on the southern markets, due doubtless to the variety used by the New Jersey and Maryland packers, yet it is gradually coming to be better known, and there are now a great many canned in the South, the home of the potato. No difficulty whatever is met with in canning and keeping them. They are put up in three-pound cans, and the medium size potatoes are preferable, as they fit in the can much better. The potatoes are first boiled in a large vessel until the skin readily slips off. They are then packed in 10 degree cane sugar syrup, and exhausted in ten minutes and processed in twenty minutes. One bushel will, on the average, put up 24 three-pound cans.

Peaches.

There is no article as simple and easy to can as the peach, but to put up a first-class grade of goods, experience and care are necessary. The fruit must be at the proper stage of ripeness. For market canning the free stones are the most profitable, and any good variety, such as the Elberta and Early Crawford, will answer the purpose. Two grades are usually put up; the fancy grade is of the best peaches, packed in a 10 degree cane sugar syrup; and the pie peach, or second grade, is packed in their own juice. One bushel will, on the average, fill 20 three-pound cans of the fancy grade. Peaches are exhausted in eight minutes and processed in fifteen minutes. Pears are put up the same as peaches, except only the fancy grades are packed.

Berries.

All the berries, including blackberries, strawberries and raspberries are canned in their own juice, and require but little boiling to insure perfect sterilization. They are usually packed in two-pound cans, exhausted five minutes and processed ten minutes.

Cane Syrup.

Fancy syrups are now very largely put up in tin cans, in quart, one-half and gallon sizes, and the demand for this style of packing is constantly increasing, and there is no reason why the small farmers that have land suitable for cane growing, should not find it a profitable source of income aside from their usual crops. The constant aim should be to produce a syrup of the very highest quality, if the object is to put it on the market. The syrup should be filled into the cans as it comes from the evaporator, while yet hot, and the cans immediately soldered air tight. Before marketing, the cans should be wrapped in attractive labels, bearing the name of the producer.

As to Canning Outfits.

The question of a canning outfit is one to be settled according to individual circumstances and preferences. There are a number of patented outfits now offered to the public that do satisfactory work when properly operated, and we are frequently asked the question, whether or not it is necessary to purchase one of these patented outfits in order to do successful work. While admitting their convenience of operation and low cost in most instances, we answer no; it is not necessary. Any farmer, at very little expense, can build his own canning plant that will do the best work and last for years.

An outfit with a capacity from four to six hundred cans per day can be built at a cost not exceeding $40, as follows: Construct a brick furnace about six feet long, two and one-half feet wide and of the same height, with grate bars, the grates being about one-half the length of the furnace. On the top have two "eyes," into each of which fit a cast iron kettle, holding about twenty-five gallons; let about two-thirds of the kettles down into the furnace, so they can be quickly heated and kept boiling at an even temperature. The kettle nearest the front of the furnace is used for exhausting, and the back one for processing, or cooking. Wire or wooden baskets can be made for lowering the cans and lifting them out, which can either be performed by hand or by means of a "crane," which any carpenter can make. Can tongs, soldering coppers and heating furnace for coppers can be purchased from any hardware dealer. This, together with two tables about 3x6 feet, and a shed over the entire outfit, will constitute a canning plant that will admirably serve the purpose. For canning only for family use, a much smaller outfit would be amply sufficient.

The ordinary "steamer" used on the cook stove is ample for processing and cooking in small quantities. The common tin boiler that accompanies the equipment of most stoves and ranges will meet the requirements in most cases, when preserving for family use only is desired.

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The Chemistry of the Sugar Cane and Its Products in Louisiana.

BY

C. A. BROWNE, Jr., and
R. E. BLOUIN.

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The Bulletins and Reports will be sent free of charge to all farmers, on application to the Director of the Stations, Baton Rouge, La.

The Chemistry of the *S*ugar Cane and Its Products in Louisiana.

(By C. A. Browne, Jr., and R. E. Blouin.)

The data collected in this bulletin represent a summary of work performed during the past few years in the sugar house and laboratories of the Sugar Experiment Station of the Louisiana State University at Audubon Park, New Orleans.

I. COMPOSITION OF THE SUGAR CANE.

As is well known, the sugar cane in Louisiana, on account of the cool winters, seldom reaches maturity. It is only during an exceptionally mild winter that the cane arrows and produces seed, and this occurrence then is confined entirely to the extreme southern parishes of the State along the Gulf. The conditions of growth, and the methods of cultivating the cane crop in Louisiana are therefore necessarily very different from tropical countries, and as a result very marked differences are evident in the composition of the cane and its products between the two regions. It should also be remarked that within Louisiana itself, a great dissimilarity of conditions prevail, not only as regards climate, but also in the character of soils and processes of manufacture, so that there are perhaps wider local variations in composition than are noticeable in any other cane-producing country.

Table No. I shows the proximate composition of the leaves, stalks, roots and seed of the sugar cane, according to analyses by Halligan and Agee.

TABLE NO. I.

(Proximate Analysis of Sugar Cane.)

		Leaves.	Stalks.	Roots.	Seeds.
Water		74.38%	74.96%	68.79%	11.03%
Ash		2.23	0.64	1.87	5.22
Fat and Wax		0.69	0.38	0.54	2.01
Nitrogenous bodies, (protein, etc.)		1.70	0.58	1.59	8.47
Fiber	Crude cellulose	9.18	4.86	9.58	25.51
	Pentosans	5.49	3.04	7.04	26.26
	Ligneous bodies	4.13	2.14	4.25	21.50
Sugars, etc.		2 20	13.40	6.34	....
Total		100.00	100.00	100.00	100.00

A somewhat closer inspection of the various constituents given in Table I will be of value, particularly as regards the composition of the cane stalk.

Water. The water content of the sugar cane is somewhat variable, decreasing as the period of maturity advances and also depending upon the wetness or dryness of the season. Canes after being cut lose water rapidly from evaporation, with a corresponding increase in the per cent of solids in the juice. Analyses of juices from canes that have been long windrowed or shipped a considerable distance frequently lead to erroneous conclusions regarding sugar content.

Ash. The percentage composition of the ash of the sugar-cane in Louisiana is found to vary widely according to the variety of the cane, type of soil and manner of fertilization. Analyses made by Hall of the ash from the leaves. stalks and roots of the Demerara No. 74 cane are given in Table II.

TABLE II.

(Composition of Ash of Sugar Cane.)

		Ash of Leaves.	Ash of Stalk.	Ash of Roots.
Potash	K_2O	31.25%	38.23%	17.39
Soda	Na_2O	1.17	1.30	0.85
Lime	CaO	5.90	5.19	3.45
Magnesia	Mg O	5.11	5.76	2.61
Iron Oxide	$Fe_2 O_3$	1.45	1.13	3.60
Alumina	$Al_2 O_3$	1.03	0.25	4.70
Silica	$Si O_2$	30.32	15.70	49.52
Phosphoric Acid	$P_2 O_5$	7.25	5.27	3.99
Sulphuric Acid	$S O_3$	11.29	18.47	9.15
Carbonic Acid	CO_2	1.10	2.70	0.45
Chlorine	Cl	3.08	4.55	0.98
Carbon	C	0.16	0.54	2.30
Total		99.09	99.06	98.99
Deduct 0=Cl		0.70	1.02	.22
		98 39	98.04	98.77

Fat and Wax. The fat or oil of the cane is very small in amount and is confined mostly to the interior tissues, the pith and fibro-vascular bundles. The wax of the cane is found entirely upon the outer surface of the stalk and constitutes about 1 per cent of the rind. It is easily recognized by the white powdery coating which it gives the stalk, particularly in the region of the node. The properties of cane wax were first studied by Avequin, an apothecary of New Orleans, over sixty years ago.

He named the substance *cerosin* (from the Greek ceros, meaning wax) and gives the following description of its properties: "It is yellowish, very hard, easily pulverized to a white powder, and when moulded in the form of a candle burns like wax or spermaceti. It melts at 82 degrees C, solidifying again at 80 degrees. Its specific gravity is 0.961 at 10 degrees. It is odorless, unites with alkalies only with difficulty and does not change on exposure to the air." Avequin by scraping obtained more than two grams of wax from a purple stalk of cane. He also showed that an appreciable quantity of wax escaped into the juice during milling, the amount of this, however, being less than 1-100th of a per cent of the weight of juice.

Dumas, who made a chemical study of Avequin's cane wax, found it to contain 81.00 per cent carbon, 14.16 per cent hydrogen and 4.84 per cent oxygen, and regarded the substance as an alcohol of the formula $C_{24} H_{50} O$. Lewey repeated Dumas' work four years later at the latter's request and obtained for cane wax 81.74 per cent carbon, 13.64 per cent hydrogen and 4.62 per cent oxygen and assigned the formula $C_{24} H_{48} O$.

Nitrogenous Bodies. The total percentage of nitrogen in the sugar cane is relatively small, the average of many analyses made at this station being only about .05 per cent. This small amount of nitrogen is distributed among a large number of different bodies, each one of which plays an important part in the physiological processes of the cane. The distribution of the nitrogen among the different constituents of the cane can be seen from the following analyses, which were made upon several stalks of the Louisiana Purple variety:

TABLE III.

	Percentage of Cane.	
Albumen (coagulable and soluble in pepsin)	0.059	.009 N
Nucleins, etc. (coagulable, but insoluble in pepsin)	0.040	.006 N
Albumoses and peptones (not coagulable)	0.033	.005
Amido Acids (Aspartic acid)	0.145	.013-N
Amido Acid Amids (Asparagin)	0.232	.049-N
Ammonia NH_3	0.008	.006-N
Nitric Acid, $N_2 O_5$	0.071	.026-N
Total nitrogenous bodies	0.588	.114

The above percentages are subject to considerable variations according to the age and variety of the cane, manner of fertilization and cultivation. The nitrogenous bodies are not distributed evenly throughout the stalk, the work of Beeson having shown a greater localization of albuminoids in the nodes and of amids in the internodes.

	Nitrogen. Albuminoid	Nitrogen. Amid	Nitrogen. Total
Nodes	0.1778	0.0051	0.1829
Internodes	0.0559	0.0258	0.0817

Fiber. The fiber of the sugar cane is distributed among the three principal tissues, the rind or shell, the pith, and fibro-vascular bundles. A mechanical separation of these tissues of the cane from one another gave the following percentage composition. The analyses were performed upon a mature stalk of the Louisiana Purple cane.

	Pith Per cent.	Bundles Per cent.	Rind Per cent.
Whole cane (3 analyses)	2.39	1.81	5.51
Dry fiber....................	24.66	18.60	56.74 ✓ 100

A proximate analysis of the above tissues is given below. The results were calculated to a moisture-free basis.

TABLE IV.

	Pith Per cent.	Bundles Per cent.	Rind Per cent.
Ash	1.68	3.58	1.64
Fat and wax................	0.41	0.72	0.98
Protein	1.94	2.00	2.19
Cellulose (method of Cross and Bevan)	49.00	50.00	51.00
Pentosans (furfuroids).......	32.04	28.67	26.93
Lignin (by difference).......	14.93	15.03	17.17

With the exception of ash the results for the different tissues show a certain regularity, the bundles standing intermediary between the pith and the rind. The analytical data shows that we have in the pith a minimum and in the rind a maximum degree of lignification.

The fiber is not distributed evenly throughout the cane, the contents of woody matter being twice as high in the region of the nodes. Beeson, who has made a special study of this point, gives the following analyses. (Bull. 38, La. Sugar Expt. Station, p. 1353.)

Top	Node	15.86%
	Internode	8.60
Middles	Node	15.90
	Internode	8.00
Butt	Node	18.20
	Internode	8.08

A study of the hydrolytic products obtained by digesting purified bagasse with caustic soda showed cane fiber to be an exceedingly complex substance. The following results calculated to 100 parts of cane-fiber (protein, ash, fat, etc., excluded) give the approximate percentage of the different hydrolytic products.

	Per cent.
Cellulose (including oxycellulose)	55
Xylan	20
Araban	4
Lignin	15
Acetic Acid	6

The *cellulose* $(C_6\ H_{10}\ O_5)n$, obtained from the sugar cane resembles that obtained from corn stalks in many of its properties. The pith cellulose is very easily attacked by concentrated alkalies and for this reason great care must be exercised in manufacturing paper-stock from bagasse.

The *Pentosans,* xylan and araban $(C_5\ H_8\ O_4)n$ constitute the cane gum. These constituents of the fiber are easily soluble in alkalies, from which they are precipitated by alcohol as a gummy deposit. Inversion of the cane gum with hydrochloric acid produced the pentose sugars, xylose and arabinose, $(C_5\ H_{10}\ O_5)$, which on removal of the acid, were easily obtained in the crystalline form. The specific rotation of xylose obtained from cane gum was found to be +18.5 and of arabinose +104.2.

The *Lignin* is obtained from cane fiber by digesting with solutions of alkalies to which it imparts a yellowish brown coloration. After removing the pentosans with alcohol, the lignin can be precipitated by evaporating the filtrate and adding a slight excess of acid. It constitutes a resinous deposit easily reduced to a yellowish powder, and soluble in alcohol and alkali solution. The elementary composition of the purified lignin obtained from cane fiber was found to be:

	Found. I	Found. II	Theoretical for $C_{24}H_{26}(CH_3)_2O_{10}$
Carbon	61.89%	61.75%	61.90%
Hydrogen	6.17	6.14	6.35

The constitution of cane lignin agrees with the formula proposed by Lindsey and Tollens for wood lignin given above.

Acetic Acid, CH_3 COOH, the well known acid of vinegar, may be obtained from cane fiber by digesting with caustic alkalies and then distilling with a slight excess of sulphuric acid.

The above substances do not exist in cane fiber as a mechanical mixture, but in a state of most intimate combination, forming a very complex molecule whose exact structure is not yet understood.

The Sugars. The three principal sugars of the cane are sucrose, dextrose and levulose.

Sucrose, ($C_{12}H_{22}O_{11}$), is the constituent for which the cane is most prized and its physical properties are too well known to require mention. Its solutions rotate the plane of polarized light to the right, the specific rotation being +66.5. By means of inverting agents sucrose is split up into equal parts of dextrose and levulose, hence the name of the mixture—invert sugar.

Dextrose, ($C_6H_{12}O_6$), sometimes known as grape sugar, occurs in all parts of the sugar cane. It is a white crystalline body, easily soluble in water, the solution rotating to the right. Specific rotation +53.

Levulose, ($C_6H_{12}O_6$), sometimes known as fructose or fruit sugar, occurs associated with dextrose in all parts of the sugar cane. It is easily soluble in water and much less easily crystallized than dextrose; solutions of levulose rotate strongly to the left, the specific rotation at 20 degrees C being —89.2. Both dextrose and levulose, like other simple sugars, exert a strong reducing action upon alkaline copper and silver solutions, and from this property are often termed reducing sugars. In commercial work dextrose, levulose and other reducing bodies are generally comprised under the one term glucose, although chemically speaking the word glucose is only applicable to dextrose.

The pentose sugars, xylose and arabinose, seem to occur in traces in decomposed canes, the result no doubt of the inversion of the xylan and araban contained in the fiber. The presence of maltose and raffinose has also been reported in the sugar cane, but this requires confirmation. The optically inactive sugar of the cane, anoptose, which has been reported, is probably only an inactive mixture of dextrose and levulose.

Among other ingredients of the cane which have not been mentioned are the Pectins or Gums, and the Acids.

Pectins or Gums. The sugar cane contains a small amount of pectinous or gummy matter, which escapes into the juice during the milling. These gums are soluble, but are thrown out as a flocculent precipitate on adding alcohol to the concentrated juice. The quantity of soluble gums is much higher in some varieties of cane than in others. The gums of the juice are derived entirely from the hemicellulose of the cane fiber and are composed of xylan and araban, with some galactan, the latter being more evident in unripe canes than in canes which have reached maturity.

Acids. The acids of the cane exist partly in the free condition, the larger amount, however, occurs combined with potash and other bases in the form of salts. On incineration these organic salts are destroyed, the basic constituents being left in the ash as carbonates. Among the acids of the sugar cane are aspartic acid (already mentioned among the nitrogenous bodies). malic acid, and succinic acid, all closely related to one another constitutionally and physiologically. Glycolic acid also occurs in green canes. Tannic acid is always present, especially in the peripheral region and in the growing parts. The tissues near the buds and eyes of the cane always give a strong reaction for tannin bodies. Citric, tartaric and aconitic acids have also been reported in the cane, but their presence requires further confirmation.

Among other constituents of the cane which have not been enumerated, should be mentioned the coloring matter. The chlorophyll which gives the leaf of the cane its green color is also present in very small amount in the stalk, though its presence there is often marked by a red or purple coloring-matter (anthocyan), as in the Purple, Striped and other colored canes.

Starch is another ingredient which occurs in the leaf of the cane and in traces in the green portions of the stalk. In the mature joints, however, starch is almost if not completely absent. The relationship of starch to the sugars of the cane will be discussed under the next section.

II. THE PHYSIOLOGY OF THE GROWTH AND RIPENING OF SUGAR CANE.

During germination and for the first few weeks of its growth the young sugar cane is entirely dependent for its supply of plant food upon the mother cane. This food supply is largely made up of sugars and nitrogenous material. The sucrose of the mother cane undergoes a slow inversion, as is always the case in plants when this reserve material is to be transported to points of growth. Juice from a sound mother cane that had lain in the ground two years at Audubon Park contained 1.40 per cent of sucrose and 0.91 per cent of reducing sugars, so it will be seen that the process of inversion is one of long duration. This inversion of sucrose goes on more rapidly in the region of the bud and is due to the activity of an inverting ferment or enzyme developed during the process of germination.

In addition to the inversion of sucrose, the albuminoids of the mother cane undergo a transformation, being first changed by enzymes to albumoses or peptones and then still further reduced to asparagin and aspartic acid in which form they are transported to the young plant. The work of Beeson, previously referred to, shows that the quantity of albuminoid material is three times greater in the nodes than in the internodes, which circumstance is clearly a provision of the mother cane for the needs of the growing bud. The presence of considerable asparagin in the young suckers of sugar cane was demonstrated by Maxwell. The asparagin and other amid bodies derived from the albuminoids of the mother cane are again transformed in the young plant to albumen, which is the principal constituent of the cell protoplasm. The sugars are changed to cellulose and hemicellulose, and go to build up the cell walls and tissues of the growing plant.

As soon as the young cane has developed leaves and roots it gradually ceases to be dependent upon the mother cane and is in position to shift for itself. The process of assimilation now begins; the carbonic acid of the air and the water taken up through the roots undergo a transformation in the chlorophyll bearing tissues of the leaf, with the result that starch and also probably sugar are formed. The presence of starch in cane leaves can be very easily demonstrated by dissolving the chlorophyll in boiling alcohol and then applying tincture of iodine, when the starch grains will be colored blue. In this process of assimilation oxygen is set free, as is shown by the following formula:

Carbonic acid. Water. Starch (sugar). Oxygen.

$$12\ CO_2 + 12H_2O = C_{12}\ H_{20}\ O_{10}\ (2H_2O) + 12O_2$$

The process of assimilation can only go on in the sunlight; it ceases during the night and is of course less active on cloudy days than when the sky is clear.

Parallel with the formation of starch and sugar in the leaf is the formation of albuminoid matter. The nitrates and sulphates of the soil are taken up by the roots, together with the other mineral constituents and are transported in solution to the leaf, where a combination of the nitrogen and sulphur with the sugars is effected with the formation of albumen. The exact nature of this change, which is of an exceedingly complex character, is not yet understood. Hofmeister's formula for albumen is $C_{450}\ H_{720}\ N_{116}\ S_6\ O_{140}$, and such a compound would require 75 molecules of dextrose, 116 of potassium nitrate and 6 of calcium sulphate for its formation.

In addition to the starch which is formed in the leaf of the cane a considerable amount of sucrose is formed. This sucrose may be formed directly in the process of assimilation or it may be derived secondarily from the starch. But neither the starch nor the sucrose remain as such in the leaf for any length of time, both being converted by enzymes to reducing sugars and then transported to points of growth where they are utilized in the building up of new tissue. This process of conversion goes on at night as well as by day, the assimilative products which accumulate by day being in large part removed during the night.

These and other changes which go on in the young cane can best be illustrated by the following analyses made upon the juice from the leaves of a young cane at night and at morning, and from different parts of the stalk of the same:

TABLE V.

	Evening. Per cent.	Morning. Per cent.
Brix	5.77	5.09
Sucrose	0.94	0.54
Dextrose	0.63	0.86
Levulose	0.69	0.77
Ash	1.42	1.24
Free Acid	0.27	0.27
Combined Acid	0.62	0.54
Nitrogenous bodies	0.15	0.18
Gums	0.30	0.17

We notice in the juice of the leaves a large decrease in the amount of sucrose during the night with a corresponding increase in the amount of reducing sugars. In the top joints we note an accumulation of the reducing sugars brought down from the leaves; at this point, which is the region of most intense growth, we have the greatest disparity between sucrose and reducing sugars, the glucose ratio being 461.84. In the middle joints where the process of growth is being suspended, we observe that the reducing sugars are being reconverted to sucrose, which is henceforth stored up in the pith cells as reserve material. The bottom joints illustrate the same facts only to a greater degree. Regarding the other constituents it will be seen that the percentages of ash, free and combined acid, nitrogenous bodies, and gums all decrease as we pass from the leaves down the stalk.

The same phenomena may be observed if we compare the analyses of whole canes made at different periods of their growth. In the following table analyses are given of D.74 and D.95 canes at various intervals between the middle of July and the middle of October.

TABLE VI.

(Analyses by Halligan and Verret.)

Variety.	Ingredient.	July 19.	Aug. 2.	Aug, 17.	Sept. 1.	Oct. 3.	Oct. 17.
D. 74	Weight stalk	544 gm.	584 gm.	916 gm.	1364 gm.	1431 gm.	1243 gm.
	Fiber	3.84 %	4.32 %	6.36 %	....	7.96 %	8.18 %
	Sucrose	1.50	2.14	4.88	6.07 %	8.59	11.04
	Dextrose	1.72	1.75	4.75	1.72	1.85	1.05
Stubble	Levulose	1.69	1.64	1.49	1.38	1.31	.87
	Ash	.57	.49	.48	.49	.42	.43
	Acids	.26	.25	.22	.22	.20	.18
	Albuminoids	.10	.09	.08	.06	.07	.08
	Amids	.08	.04	.06	.04	.03	.04
	Gums	.19	.17	.13	.16	.07	.09
D. 95		July 29.	Aug. 15.	Aug. 26.	Sept. 7.	Oct. 3.	Oct. 17.
	Weight stalk	466 gm.	651 gm.	854 gm.	1050 gm.	1375 gm.	1116 gm.
Stubble	Fiber	....	5.10 %	5.59 %	6.57 %	7.82 %	8.10 %
	Sucrose	1.23 %	2.45	3.02	4.43	8.19	8.92
	Dextrose	1.92	2.06	2.37	1.98	2.22	1.46
	Levulose	1.81	1.81	1.98	1.94	1.55	1.37
	Ash	.46	.41	.29	.34	.32	.38
	Acids	.23	.22	.17	.17	.12	.13
	Albuminoids	.11	.09	.08	.07	.06	.08
	Amids	.06	.05	.02	.03	.03	.04
	Gums	.10	.05	.05	.07	.04	.07

Pressure of other work prevented the analyses being carried through to the complete maturity of the canes, yet the results are sufficient to illustrate the general character of the changes during the period of growth. We note a regular increase in the percentage of fiber and sucrose, although the increase of these two ingredients does not go on *pari passu* as has been sometimes claimed. Attempts to establish a fixed ratio between fiber content and sucrose content are absolutely futile. The percentages of ash, acids, nitrogenous bodies and gums all show a decrease as the cane matures.

The relations of the sugars of the cane to one another during the period of growth and their effect upon the polarization of the juice is a subject of more than theoretical importance to the sugar planter.

It will be observed from the analyses in Tables V and VI that the reducing sugars, dextrose and levulose, in the green tops and joints of the cane and also in the stalks of very young canes, are present in very nearly equal amounts; in other words, they are present as invert sugar, being derived, as we have seen, by the inversion of the sucrose in the leaf. In the riper joints of the cane, however, this relation no longer exists. A considerable quantity of the invert sugar is reconverted into sucrose, but another portion is consumed in the vital processes of the cane (formation of new tissue, etc.); for the latter purpose levulose appears to be used in greater amount than dextrose with the result that the latter sugar is left in excess. The disparity in the percentages of dextrose and levulose increases as the cane matures until finally the levulose may nearly disappear, as in the following analysis of the juice from T.111 cane made November 28, 1903, at Audubon Park.

Brix	19.45
Sucrose	18.29
Dextrose	0.21
Levulose	0.04

The above condition of maturity was due to exceptional climatic conditions during 1903, and is very rarely attained in Louisiana. In tropical countries, however, where complete maturity of the cane is attained the levulose of the sugar cane may disappear. (Went. Chem. Physiol. Untersuch. des Zuckerrohrs Jahrbuch. für wissenschaft. Botanik XXXI, p. 289.)

These fluctuations in the percentages of the different sugars naturally affect the polarization of the juice to a marked degree. The relation between the sugars and polarization of cane juice at different periods of growth of the Purple cane in 1903 is shown in the following diagram:

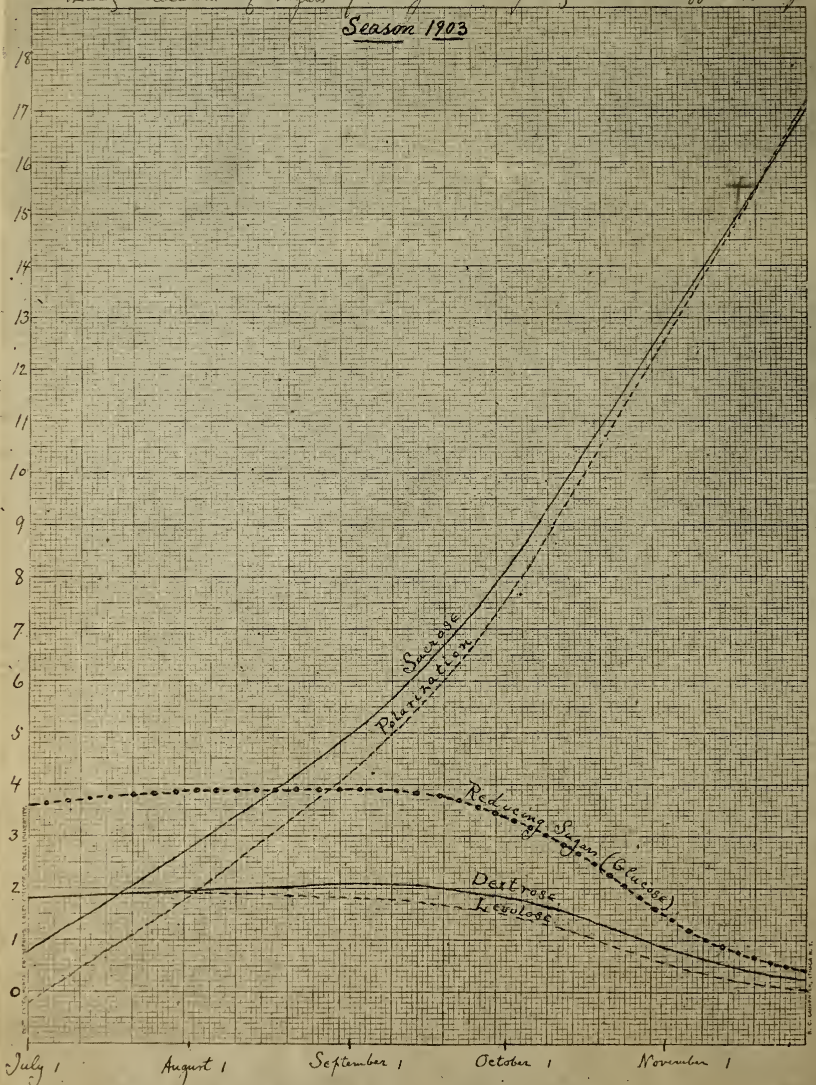

Diagram showing relation of sugars of cane juice to polarization at different stages.

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The Reducing Sugars (or Glucose as they are generally but improperly termed) represent the sum of the Dextrose and Levulose.

It will be noted that at very early stages of growth the juice shows a minus reading due to the preponderance of invert sugar; somewhat later the juice becomes inactive, showing no rotation whatever, though double polarization shows about 1 per cent of sucrose. Then the rotation becomes a positive quantity and as the cane matures gradually approaches the true percentage of sucrose until finally the polariscopic reading and true percentage of sucrose coincide. At the latter stage the polarizing powers of dextrose and levulose neutralize one another. If conditions are favorable for complete ripening the levulose will nearly disappear. The rotary power of dextrose then predominates with the result that the polariscopic reading slightly exceeds the true percentage of sucrose. The latter condition, however, very rarely prevails in Louisiana. Under very exceptional climatic conditions the reducing sugars of the cane have been reported to disappear completely, in which case the polarization and sucrose content will again coincide. A case of the latter kind was reported in 1903 by Dr. H. W. Wiley upon canes grown in Florida.

III. PHYSIOLOGICAL ROLE OF THE ENZYMES OF THE SUGAR CANE.

Reference has already been made to certain nitrogenous ferments or enzymes which occur within the cane. Though present in but exceedingly minute amounts these ferments play a very important role in the physiological processes of the plant and require more than a passing mention.

If the green tops of a sugar cane be well macerated, the juice expressed, and treated with an antiseptic agent, such as chloroform or thymol to prevent fermentation by yeasts or bacteria, it will be found that the sucrose content of the juice undergoes a gradual diminution, though no traces of micro-organic life are evident, and that simultaneously with this decrease in sucrose the content of reducing sugars increases. We have here a well marked instance of the activity of the enzyme *invertase*, the presence of which was noted in the leaf of the cane; this enzyme occurs almost universally throughout the vegetable kingdom, especially in the green or growing parts of plants. This presence of invertase has a very practical bearing outside of its physiological importance. The gradual falling off in sucrose content of sugar cane which has been windrowed for any length of time is due very largely to spontaneous inversion. If the green tops of the cane are removed at the time of cutting, the loss of sucrose is much less evident. This can be easily seen in the following series of experiments which were carried out at Audubon Park in 1893. Several lots of cane were windrowed, one-half of each lot having the tops removed, and the other half retaining them. In all other respects the conditions of the experiments were perfectly similar. At the end of a month all tops were removed, the stalks from the different lots ground and the juices analyzed with the following results:

TABLE VII.

	Brix.	Sucrose.	Glucose.
Lot 1—Windrowed with tops cut.......	16.1	13.3	1.25
Windrowed with tops on.......	15.9	12.1	1.85
Lot 2—Windrowed with tops cut.......	15.8	12.8	1.22
Windrowed with tops on.......	15.4	11.5	1.53
Lot 3—Windrowed with tops cut.......	16.3	13.5	1.25
Windrowed with tops on.......	16.1	12.6	1.92
Lot 4—Windrowed with tops cut.......	16.2	13.7	1.00
Windrowed with tops on.......	15.8	11.8	1.85
Lot 5—Windrowed with tops cut.......	15.9	12.8	1.39
Windrowed with tops on.......	15.0	10.7	2.17

The loss of sucrose due to spontaneous inversion is very evident and this we can attribute very largely to the diffusion of the inverting enzyme from the green tops into the stalk. The inversion of sucrose naturally causes an increase in the glucose content, though this increase, it will be noted, is not proportioned to the loss in sucrose. This discrepancy is probably due to a destruction of the glucose from respiration in the leaf. The experiments show conclusively that the vital processes of the cane go on even after it is cut. It should not be forgotten that there is also a slow inversion of sucrose in canes that are windrowed with the green tops removed, though this inversion is attended by the concentration which the solids of the juice undergo from evaporation.

A very marked peculiarity of sugar cane juice, as of all vegetable juices, is the rapid darkening in color which takes place immediately after expression. This darkening is much more evident within the body of the cane, especially in the region of the eyes and growing parts, when its tissues are laid open to the air. We have here the evidence of another enzyme belonging to the class of oxydases. The intense blue coloration which the tissues and juices of plants take on with tincture of guaiac is ascribed to an oxydase; the decomposing action which plant extracts exercise upon hydrogen peroxide discovered by Schoenbein, has been similarly explained, though Loew attributes the latter phenomenon to a special enzyme, catalase, and Pozzi Escot to a new class of ferments called reductases. Juice from sterilized cane exhibits none of the reactions named.

If certain polyphenols, such as hydroquinon, or pyrogallol, are added to fresh cane juice, a rapid oxidation of these compounds is produced with an intense darkening of the juice. The latter takes on at the same time a peculiar odor, due probably to the formation of a quinone body, and what is more remarkable, acquires a germicidal property which, in the case of the hydroquinone treated juice, insures its preservation for weeks. Sterilized juice shows no change in color and develops no germicidal properties with any of the phenol bodies named.

The darkening of vegetable tissues on their exposure to the air, has been explained by Bertrand to be due to the action of an oxidizing enzyme upon various tannin bodies, all more or less related to the polyphenols, and the query naturally arises, does cane juice itself exercise any germicidal properties in connection with the natural phenomenon of darkening? The conclusion which I have reached in investigating this point is that cane juice does acquire for a time such germicidal characteristics. Counting the bacteria in the expressed juice of the cane at regular periods usually shows for several hours a uniform decrease in numbers; with juice from sterilized canes, on the other hand, the bacterial content increases from the very start.* But it is especially within the body of the cane itself that this germicidal action is most evident, as when the cellular tissues are bruised or otherwise laid open to the air, and this we might expect not only from the colloidal and adherent character of the enzymes, which renders them resistant to expression, but from the fact of localization which will be discussed later.

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*NOTE.—In this connection it is interesting to recall the vast amount of work done by Hunziker and others upon the germicidal action of fresh milk, and it may be that certain enzymes which we know to be always present in milk, exercise also here a toxic action.

If we take two stalks of sugar cane, one raw and one sterilized, and puncture them with a knife, we will observe at the end of a few days a marked difference in the character of the wounds. The surface of the wound in the raw cane will be discolored, but free from the evidence of fermentation; the surface of the wound in the sterilized cane, on the other hand, will not be thus discolored, but will be badly infested with bacteria and moulds. When the sugar cane is attacked by the borer or beetle, the pathway of the insect is much discolored, but we notice no inroad of organisms into the sound tissues. The living plant therefore does appear to protect itself against the invasion of microscopic parasites by forming toxic products. In case the sugar cane is killed, as sometimes happens during a freeze, this power of protection is lost. The formation of toxic products does not go on, hordes of bacteria invade the cane, and finding no resistance, start a fermentation which soon renders the cane worthless for milling.

The question may be asked if these toxic products are so deadly to micro-organic life, why do they not react unfavorably upon the cane itself? It is just here that the reducing or catalyzing enzymes perform their functions, for should the toxic oxidation products diffuse inward beyond the points of their formation, they are at once reduced and thus exert no action deeper than the exposed surface.

It will be seen that there must be a great difference between working with enzymes before and after expression from the cane. As Pfeffer remarks in his Plant Physiology, "The living cell must not be judged by reactions obtained with dead material or in the expressed juice." That there is a localization of the enzymes within the plant is rendered very evident if we apply the guaiac test to the cross section of a cane stalk; the blue coloration is developed the strongest upon the peripheral parts, showing that the oxidases are apparently more localized in this region. Pozzi Escot* has demonstrated that the same condition exists with other plants such as the potato; his experiments show, however, that the oxidases exist in the inner tissues as well, but that the greater localization of the reductases in these parts interferes with the guaiac reaction. Jacoby* goes even a step further and states that the localization of ferments exists not only in the tissues, but within the individual cell. He sums up the situation very briefly in these words: "The work of the cell can be determined with absolute certainty only when we learn to separate in the test tube the substances which are separated in the cell, and allow the individual ferments to do their work in proper sequence and in proper concentration."

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*American Chemical Journal, June 1903, page 530.

In addition to the enzymes named there are other natural ferments which play an important part in the vital processes of the cane. In the leaf we have evidences of the activity of a diastase by which the starch that is formed in the chlorophyll grains is converted into sugar. We have already called attention to the presence in the mother cane of peptonizing enzymes, by which the albuminoids are broken down into soluble nitrogenous compounds easily transportable to the young plant.

It will be impossible to dwell longer upon the functions and properties of these various ferments which occur within the cane, enough having been said, however, to indicate the physiological importance of this class of compounds.

IV. CONDITIONS AFFECTING THE COMPOSITION OF THE SUGAR CANE.

There are a number of factors having an influence upon the composition of the sugar cane that require a brief consideration. Among these may be mentioned the influence of climatic conditions, influence of variety of cane, influence of cultivation, and infiuence of soil and fertilization.

INFLUENCE OF CLIMATIC CONDITIONS UPON COMPOSITION OF CANE.

Reference has been made to the influence of climatic conditions upon the ripening of cane. This can best be seen by comparing analyses of juices at different periods for the successive years 1903 and 1904, which were very dissimilar as regards weather conditions.

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*Ergebnisse der Physologie I, 1, page 213.

TABLE VIII.

1903.

	Aug. 1.	Sept. 1.	Oct. 1.	Nov. 1.	Nov. 15.
Sucrose	2.70	5.97	11.27	13.60	15.86
Glucose	3.80	3.68	2.51	1.02	.63
Purity	36.00	57.02	76.72	87.85	92.10

1904.

	Aug. 1.	Sept. 1.	Oct. 1.	Nov. 1.	Nov. 15.
Sucrose	2.35	5.13	8.04	9.13	12.00
Glucose	4.04	3.75	3.55	2.82	1.66
Purity	32.28	52.35	66.61	71.55	80.53

The weather conditions for the past two years in question during the growing season were as follows:

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. daily temperature, F., 1903	82.80	82.10	77.00	67.90	58.00	49.00
Av. daily temperature, F., 1904,	80.90	84.10	84.20	71.20	64.30	58.40
Rainfall inches, 1903	5.55	5.98	1.27	0.36	0.23	3.89
Rainfall inches, 1904	6.47	5.75	3.24	0.75	1.50	3.02

The results for the two years show but little variation up to the middle of September. After this date the canes of 1903 increased considerably faster in sucrose, and this increase continued until the end of the season, when it exceeded 3 per cent. The average daily temperature and rainfall for the two years were also about the same during June, July and August; for the remaining months of the year, however, the conditions were very unlike. September, October, November and December of 1903 showed daily averages in temperature of 7, 3.3, 6.3 and 9.4 degrees respectively lower than the corresponding months of 1904; 1903 also showed a deficiency of rainfall of 1.97, 0.39 and 1.27 inches for the months of September, October and November. These conditions for 1903 were very adverse to the growth of cane, yet hastened the ripening to an extent rarely attained in Louisiana. On the other hand, the unusually warm weather of the fall of 1904, together with favoring rains, promoted the growth of canes even into December, but retarding the ripening. The tonnage was high, but the sucrose content low. These differences in conditions naturally made themselves very noticeable in the sugar house, owing to the much lower purities of the juices and the relatively larger amount of water requiring evaporation.

INFLUENCE OF VARIETY UPON THE COMPOSITION OF CANE.

That the different varieties of the sugar cane differ from one another in the sugar content and purity of their juices is too well known to require special mention. These differences, however, are not confined to sugar content, but extend to the other ingredients of the cane as well. The physiological peculiarities of the different canes are as well marked as the differences in color or shape, and are much more potent as regards effect upon the chemical composition.

An interesting fact in the above connection is the matter of ash content. We have in the ash an imperfect yet a fairly comparative measure of the transpired water for each variety of cane, since the mineral matter in solution as it enters the plant from the soil, accumulates in proportion to the degree of evaporation from the leaf surface. In the following table are given a few results taken from analyses of juices made the middle of August, which is about the period of most rapid growth:

TABLE IX.

	D. 74.	D. 95.	Purple.	Striped.
Sucrose	4.88	2.45	2.35	2.03
Glucose	3.24	3.87	4.04	4.26
Ash	.48	.41	.40	.34

The ash content is much higher in the juice of D.74 than in any of the other varieties; D.95 stands second, Purple third and Striped fourth. This is also their relative position in sucrose content; as regards reducing sugars the order is the reverse of this. From the above results, which hold true during the entire period of growth, we may conclude that of the several canes studied, the D.74 is the most vigorous feeder, thus requiring upon poor soils a heavier fertilization; we may also say that the D. 74 has the greatest powers of assimilation and conversion, as is shown by the higher content in sugars and lower glucose ratio. The experiments upon the different varieties are to be continued during the present season and a more complete synopsis of the results will be presented later.

The effect of variety upon the composition of the ash of the juice will be shown in a subsequent table.

Influence of Conditions of Cultivation Upon Composition of Cane.

Conditions of cultivation have a very marked influence upon the composition of sugar cane. Good tilth and thorough cultivation favor the growth of the cane, whereas a poor condition of the soil has the opposite effect. The difference in growth and composition can best be appreciated by comparing the analyses of plant and stubble canes. The following table gives the composition of Striped and D.74 canes for *plant, first year stubble* and *second year stubble,* during the latter part of September, 1904:

TABLE X.

(Analyses by Chiquelin and Verret.)

		Plant.	1st year Stubble.	2d year Stubble.
Striped cane.	Weight stalk	1894 gm.	1262 gm.	1042 gm.
	Fiber	6.56 %	7.45 %	8.02 %
	Sucrose	4.79	6.03	8.45
	Dextrose	2.05	2.27	1.97
	Levulose	1.60	1.73	1.64
	Ash	0.39	0 27	0.27
	Acids	0.21	0.18	0.11
	Albuminoids	0.08	0.06	0.07
	Amids	0.08	0.02	0.02
	Gums	0.06	0.07	0.08
D. 74 cane.	Weight stalk	1575 gm.	1497 gm.	1163 gm.
	Fiber	6.28 %	7.12 %	7.16 %
	Sucrose	6.33	7.36	8.24
	Dextrose	1.84	1.65	1.83
	Levulose	1.35	1.20	1.12
	Ash	.40	.41	.39
	Acids	.21	.22	.18
	Albuminoids	.06	.04	.07
	Amids	.10	.03	.02
	Gums	.07	.07	09

It will be noted that the stubble canes average considerably less in weight than the plant canes. A comparison of various experiments made at Audubon Park shows that first year stubble averages about 80 per cent, and second year stubble about 70 per cent of the weight of plant cane. The stubble canes on the other hand are richer in fiber and sucrose than the plant, the second year stubble exceeding the first in these respects.

There is, of course, a physiological explanation for these differences. In stubble cane we have a partially dwarfed condition and according to a well established law, when growth is checked, maturation is hastened. Exactly the same effect is produced by the non-fertilization of cane. Canes grown upon the non-manured plots at the Sugar Experiment Station average much less in weight, but are higher in sucrose than canes which have been fertilized. The stunted growth of our stubble cane is due very largely to the inability of the crop to secure a sufficient supply of plant food, particularly nitrogen; an indication of this is shown by the deficiency of the juices from stubble cane in mineral and in nitrogenous ingredients. An inspection of the table will show this very clearly.

A comparison of many analyses made at Audubon Park upon the leading varieties of cane shows that stubble cane contains from 10 per cent to 20 per cent less ash and over 50 per cent less nitrogen than plant canes. The analyses also show that the deficiency of nitrogenous ingredients in stubble canes falls most largely upon the reserve supply of nitrogen or the amids. This is due to the greater nitrogen hunger of the stubble canes.

To maintain the vital processes of the cane a certain amount of albuminoid matter (protoplasm) is indispensable and to keep this up the plant draws upon its store of amids. An inspection of the table shows that with the stubble canes this reserve is almost completely exhausted and subsequent analyses showed no gain. With the plant canes, on the other hand, there is always a large surplus of amids, which is being continually added to during the entire period of growth.

There are a number of reasons for this partially starved condition of our stubble crops. Among the most important of these may be mentioned the partial exhaustion of fertility directly beneath the roots, by the previous crop, the difficulties in securing good tillage and the very unfavorable points of growth. The most that can be done towards helping the situation is to cultivate as thoroughly as possible and to fertilize well with nitrogenous manures.

INFLUENCE OF SOIL AND FERTILIZATION UPON COMPOSITION OF CANE.

Differences in the composition of soil naturally influence to a greater or less extent the composition of the cane and its products. This fact is well known to every one who has compared the taste of syrup or molasses from the salty cane fields of the lower coast with that from plantations which have not been subject to floodings of salt water. Canes from the lower coast contain sometimes four times the amount of chlorides as canes raised above New Orleans. The presence of an excess of salt in the soil affects very seriously the growth of the cane and also introduces various irregularities into the distribution of the different constituents.

Reference was previously made to the marked effect of fertilization and non-fertilization upon the composition of sugar cane. The effects of different fertilizers upon the composition of the cane and its juices is also well marked, but this subject would require so much space to be adequately treated that it has been reserved for a separate bulletin.

V. COMPOSITION OF SUGAR-CANE JUICE AND METHODS OF EXTRACTION.

Theoretically the juice of the cane is simply a solution of the soluble ingredients, sugars, salts, acids, etc., in the cell-water. The juice as expressed from the mill, however, contains in addition to the soluble matter a small amount of the insoluble ingredients of the cane, such as particles of fiber, wax and fat, albuminoids, dirt, etc., in suspension or in emulsion so that a filtration of the juice without previous clarification is almost an impossibility.

The composition of the average juice in Louisiana as it is obtained undiluted from the mill is given in Table XI.

TABLE XI.
(Composition of Cane Juice.)

Water	85.00 per cent.	
Ash	0.40 "	
Nitrogenous bodies	0.26 "	
Sucrose	12.00 "	
Dextrose	1.00 "	
Levulose	0.70 "	
Free Acids	0.10 "	
Combined Acids	0.15 "	
Pectin	0.10 "	
Fat and wax	0.10 "	Mechanical impurities removed from the cane during milling.
Fiber particles	0.12 "	
Dirt and earthly matter	0.06 "	
Tannin, coloring matter, etc.	0.01 "	
	100.00	

The composition of the ash from the juice of different varieties of cane according to analyses by Hall is given in Table XII.

TABLE XII.
(Composition of Ash from Sugar Cane Juice.)

	HOME CANES.		SEEDLING CANES.	
	Purple.	Ribbon.	Demerara 74	Demerara 95
Potash .... K_2O	49.63 %	47.65 %	44.21%	40.66 %
Soda .... Na_2O	1.81	1.13	1.11	0.63
Lime .... CaO	3.00	3.79	4.62	4.33
Magnesia .... MgO	3.21	3.73	7.45	5.70
Iron Oxide .... Fe_2O_3	0.70	0.45	1.15	1.48
Alumina .... Al_2O_3	0.40	0.32	0.18	1.25
Silica .... SiO_2	4.80	5.92	6.20	9.30
Phosphoric Acid.. P_2O_5	5.80	6.38	5.31	5.39
Sulphuric Acid... SO_3	20.40	20.59	22.46	23.69
Carbonic Acid..... CO_2	4.10	3.30	3.40	3.40
Chlorine Cl	5.80	5.83	5.36	3.26
Total	99.65	99.09	101.45	99.09
Deduct $O=Cl$	1.31	1.32	1.21	0.74
	98.34	97.77	100.24	98.35
Carbon and undetermined..	1.66	2.23		1.65
Alkalinity (cc$\frac{n}{10}$ per gm. ash)	36 cc	30 cc	24 cc	22 cc

The canes were all taken from the same plot and were grown under perfectly similar conditions of cultivation and fertilization. While all the analyses show a certain uniformity, the difference in composition between the ash of the home canes and the seedlings is well marked.

The distribution of the nitrogen among the different ingredients of cane juice is shown from the following analyses by Hardin in Table XIII.

TABLE XIII.
(Distribution of Nitrogen in Cane Juice.)

	Percentage in Juice.	Percentage of Total Nitrogen.
Nitrogen in albumen	.0039%	9.47%
" " nuclein bodies	.0025	6.32
" " albuminoses	.0021	5.26
" " amido acids, (Aspartic)	.0122	30.53
" " amido acid amids (Asparagin)	.0098	24.07
" " ammonia	.0024	6.18
" " nitrates	.0071	17.77
" " nitrogenous bases		
Total	0.0400	100.00

VARIATIONS IN THE COMPOSITION OF SUGAR CANE JUICE.

The various factors previously enumerated, climate, variety, cultivation, fertilization, etc., which affect the composition of the cane as a whole, also naturally affect the composition of juice, and require no further consideration at this point. There are several factors, however, that have not yet been touched upon, which have an influence upon the composition of the juice and which should be discussed before taking up the subject of clarification.

VARIATIONS IN COMPOSITION OF CANE JUICE DUE TO MANNER OF CUTTING, ETC.

As was previously mentioned, the top of the cane contains less sucrose and more of the solids not sugar than the lower portions of the stalk. The manner of topping canes, whether low or high, will therefore have considerable effect upon the composition of the juice. The following analyses by Messrs. Agee and Hall at Audubon Park, giving the composition of the juice from different parts of the cane for several varieties, illustrate this very clearly.

TABLE XIV.

(Composition of Juice from different joints of the Sugar Cane.)

TABLE XIV.

(Composition of juice from different joints of the sugar cane.)

No. of Joint	Purple				Striped				D. 74				D. 95			
	Wt. Joint in grams	Brix	Sucrose	Glucose	Wt. Joint in grams	Brix	Sucrose	Glucose	Wt. Joint in grams	Brix	Sucrose	Glucose	Wt. Joint in grams	Brix	Sucrose	Glucose
1 ...... Butt	66.0	13.2	10.20	1.25	112.0	14.7	12.35	0.96	155.5	16.8	14.80	0.42	106.0	15.9	14.40	0.25
2	86.5	13.1	10.36	1.53	128.5	14.6	12.15	1.04	170.5	16.9	15.00	0.31	139.0	15.9	14.40	0.29
3	99.5	13.0	10.10	1.64	130.5	14.6	12.00	1.22	173.5	16.8	15.00	0.31	154.5	15.9	14.30	0.33
4	101.5	13.2	10.50	1.72	135.5	14.4	11.75	1.31	183.5	16.7	14.75	0.31	145.5	16.0	14.40	0.36
5	101.0	13.1	10.10	1.72	132.0	14.2	11.50	1.42	181.5	16.7	14.70	0.35	140.5	16.3	14.60	0.35
6	100.0	13.2	10.25	1.72	129.0	14.1	11.15	1.51	172.0	16.6	14.50	0.39	120.0	16.3	14.70	0.38
7	90.0	12.9	9.85	1.85	119.0	14.3	11.10	1.66	159.0	16.5	14.25	0.44	103.0	16.6	14.90	0.35
8	64.0	13.0	9.70	2.08	106.0	14.1	11.10	1.66	148.9	16.5	13.80	0.59	96.0	16.7	14.90	0.38
9	60.0	12.7	9.00	1.88	82.0	14.0	10.75	1.66	139.0	16.4	13.50	0.78	92.0	16.6	14.70	0.46
10	55.0	12.6	8.90	1.92	71.0	14.0	10.50	1.72	127.5	16.5	13.30	0.74	84.5	16.7	14.60	0.49
11	48.5	12.4	8.55	2.04	64.5	14.0	10.40	1.85	111.5	16.4	13.20	0.83	81.5	16.3	14.00	0.74
12	44.5	12.3	8.00	2.04	57.5	13.6	9.70	1.88	101.5	16.5	13.10	1.00	81.5	16.0	13.60	0.85
13	43.0	12.0	7.20	2.12	54.5	13.4	9.40	1.92	89.0	16.6	12.90	1.13	75.5	16.2	13.50	1.04
14	42.5	11.0	6.60	2.17	48.0	12.4	8.35	2.08	54.5	15.3	11.70	1.28	57.5	15.4	11.90	1.61
15	34.5	10.5	5.50	2.27	36.0	11.4	7.30	2.22	29.5	13.8	8.60	1.88	37.0	14.0	9.10	2.38
16 .... Top	22.2	9.8	5.40	1.53	32.0	10.0	5.50	2.00	24.0	10.9	4.20	2.12	30.8	11.6	5.50	3.03

The above analyses represent each the averages of ten stalks of plant cane, cut and topped according to the methods usually followed in Louisiana. The solids not sugar in the juice increase as we go up the stalk, taking a sudden jump in the last two or three joints. In some cases the purity of the juice from the upper joints is less than one-half that from the butt of the cane. The extreme top of the cane as it is cut in Louisiana, has but little value for sugar making, as can be seen from the foregoing analyses. If the cane were topped several joints lower and the top reserved for seed as in tropical countries, juices of higher sucrose content and purity would be obtained and a great saving effected in the amount of cane reserved each year for planting.

The difference in composition of the juice from the nodes and internodes of the sugar cane has been studied by Beeson and the following results are quoted from his paper in Bulletin 38, Louisiana Sugar Experiment Station.

TABLE XV.

(Composition of Juices from Nodes and Internodes. Beeson,)

		Total solids.	Reducing sugars.	Sucrose.	Solids not sugar.
Tops	Nodes	15.5	0.66	12.7	2.64
	Internodes	16.8	1.20	15.0	1.60
Middles	Nodes	15.2	0.20	13.5	2.90
	Internodes	17.6	1.00	15.6	1.00
Butts	Nodes	14.2	0.26	11.9	2.04
	Internodes	17.2	0.89	15.1	1.21

The difference in composition of the juice within the cane is not only noticeable in the different joints, and in the nodes and internodes, but it is also very marked between the different tissues, the pith and the fibro-vascular threads or bundles. The juice from the latter is frequently forced out from the end of the cane when it passes through the rollers of the mill and analyses show it to be almost completely deficient in sugar. This phenomenon has been very clearly explained by Dodson, who has shown by numerous experiments that the juice thus expressed from the ends of the cane is simply a solution of mineral matter from the soil on its way through the vascular tubes to the leaf. "Though it traverses very near the tissues rich in sugar, it contains but little organic matter of any kind."

VARIATIONS IN COMPOSITION OF JUICE DUE TO METHODS OF EXTRACTION.

In the extraction of juice from sugar cane by the mill, the amount of mechanical impurities introduced into the juice will vary according to the pressure of the rollers. Accordingly we would expect juice of a higher purity from the first mill or crusher than is the case with juice from the last mill. That this is exactly the result of practical experience may be seen from the following series of experiments made at Audubon Park in November, 1903:

TABLE XVI.

Purple Cane—Second Year Stubble.

Extraction first mill	64.50%
" second mill	5.50
" third mill	2.13
Total extraction	72.13%

	First Mill.	Second Mill.	Third Mill.
Brix	15.36	14.60	14.60
Sucrose	12.93	11.41	11.30
Glucose	1.54	1.29	1.23
Ash	0.37	0.58	0.77
Albuminoids	0.18	0.50	0.58
Free acid	0.10	0.11	0.14
Combined acid	0.14	0.15	0.12
Gums	0.10	0.56	0.51
Coefficient of purity	84.07	78.15	77.29
Glucose ratio	11.91	11.30	10.88

The great increase in the ash, albuminoids and gums in the juice of the third mill is especially noteworthy, the coefficient of purity showing a decrease of nearly seven units from that of the first mill. If water or steam be employed for saturation in connection with the milling the percentages of impurities in the juice will be still further increased as can be seen from the following two series of experiments carried out at the same time as the previous one:

TABLE XVII.

Cold water saturation (20 per cent)—Purple Cane-plant.

Extraction first mill	66.50%
" second mill	12.15
" third mill	4.51
Total extraction	76.83%

	First Mill.	Second Mill.	Third Mill.
Brix	15.73	10.48	6.93
Sucrose	14.01	8.65	5.64
Glucose	0.83	0.46	0.34
Ash	0.35	0.37	0.31
Albuminoids	0.12	0.22	0.21
Free acid	0.08	0.07	0.06
Combined acid	0.10	0.09	0.08
Gums	0.24	0.62	0.29
Coefficient of purity	89.07	82.53	81.38
Glucose ratio	5.92	5.32	6.03

TABLE XVIII.

Steam saturation—Purple cane—first year's stubble.

Extraction first mill	64.31%
" second mill	8.00
" third mill	4.52
Total extraction	76.83

	First Mill.	Second Mill.	Third Mill.
Brix	15 84	12.05	11.53
Sucrose	13.50	9.40	8.70
Glucose	1.37	0.97	0.88
Ash	0.37	0.57	0.65
Albuminoids	0.14	0.28	0.20
Free acid	0.09	0.13	0.14
Combined acid	0.13	0.16	0.19
Gums	0.24	0.54	0.83
Coefficient of purity	85.23	78.00	75.45
Glucose ratio	10.01	10.32	9.42

In the experiment with steam saturation a jet of steam is introduced through the turn plates between the rollers of the second and third mills. The hot steam effected a coagulation of the albuminoids, so that less of these were removed than in the process of dry extraction; on the other hand, the percentage of gums removed from the cane was very much increased with the result that the juice obtained by steam saturation was very difficult to clarify.

A considerable difference is noticeable in the composition of juices as obtained by the mill and by the diffusion battery. The following comparative experiments made by Beeson at Audubon Park, will illustrate this very clearly. The diffusion juice owing to its dilution was calculated to the same content of solid matter as the mill juice:

TABLE XIX.

Juice.	Total solids	Suc.	Gluc.	Solids not sugar.	Coeff. purity.	Gluc. ratio.	Ash.	Albu-min-oids.	Amids.	Gums, acids, etc.
Mill	14.9	11.9	1.40	1.60	80.0	11.8	0.41	0.071	0.060	0.96
Diffusion	14.9	12.14	1.57	1.29	81.5	12.9	0.48	0.044	0.071	0.70

It will be noted that the percentage of mechanical impurities such as gums, etc., is much higher in the mill juices. The hot water used in diffusion caused, on the one hand, a coagulation of a large amount of albuminoid matter, which was held back in the diffusion chips, but on the other effected the solution of a larger amount of amids and mineral matter. Maxwell has also shown (Bulletin 38, Louisiana Sugar Experiment Station) that "diffusion may take out, particularly at high temperatures, more of some bodies and less of others than are found in the normal mill juice."

VI. CLARIFICATION OF SUGAR CANE JUICE

Cane juice, as has been seen, contains in addition to sucrose, varying amounts of other ingredients, organic and inorganic, the removal of which constitutes the first and in many respects the most important operation of the sugar house. In this process of clarification, as it is called, certain of the impurities of the juice, especially those of a mechanical nature, such as fat and wax, fiber, soil, etc., may be eliminated entirely. Other impurities such as the ash, albuminoids, acids, and gums are even in the best of our present processes only partially removed, while other undesirable ingredients such as the reducing sugars, and amids are not at all precipitated by the ordinary clarifying agents employed. The work of clarification affects the composition of the cane juice by the removal of certain ingredients either in whole or in part; also by the transformation of certain of these constituents into other forms—the sucrose for example may be partially inverted, the glucose changed into acid products, or the amids and albuminoids converted into substances of a different character. The chemistry of the various processes of clarification is therefore exceedingly complex and the character of the changes which take place is in many instances very hard to follow owing to our imperfect knowledge of many of the products formed.

In our present study of the processes of clarification we will take up the action of heat alone upon juices and then the action of lime, both alone and in conjunction with sulphur dioxide. Phosphoric acid and carbonic acid, certain special processes such as superheating and electric clarification, will also be briefly discussed.

ACTION OF HEAT ALONE IN THE CLARIFICATION OF CANE JUICES.

Heat alone for clarification is never employed in the sugar house, owing, first, to the imperfect removal of many of the impurities from the juice and more especially to the great loss of sucrose from inversion by the organic acids. In the manufacture of cane syrup, however, heat is often the only means of clarification employed, since a partial inversion of sucrose for this purpose may be even desirable to prevent crystallization.

The following experiments by Agee and Hall upon clarification by heat were performed on juices of the Striped and D.74 canes. The juice after weighing was boiled for periods of one and two hours. After cooling the juice was reweighed and sufficient water added to make up for the loss by evaporation. The juices were then filtered and analyzed.

TABLE XX.

Striped Cane.

	Raw juice.	Boiled one hour.	Boiled two hours.
Total Solids	13.82	13.59	13.59
Sucrose	11.26	11.12	10.97
Reducing Sugars	1.34	1.47	1.61
Ash	0.43	....	0.44
Albuminoids	0.061	....	0.02
Amids	0.176	....	0.165
Free Acid as Malic	0.11	0.10	0.10
Gums, etc.	0.44	....	0.28
Coefficient of Purity	81.47	81.82	80.72
Glucose Ratio	11.90	13.22	14.68

D.74 Cane.

	Raw juice.	Boiled one hour.	Boiled two hours.
Total Solids	15.93	15.48	15.48
Sucrose	14.47	14.27	14.14
Reducing Sugars	0.34	0.51	0.67
Ash	0.49	....	0.45
Albuminoids	0.078	....	0.014
Amids	0.081	....	0.085
Free Acid as Malic	0.08	0.07	0.07
Gums, etc.	0.39	....	0.05
Coefficient of Purity	90.83	92.18	91.34
Glucose Ratio	2.42	3.57	4.74

The experiments show that simple boiling removed 0.23 per cent of impurities in the juice from the Striped cane and 0.45 per cent from that of the D.74. The impurities removed consisted largely of gums and albuminoids with a small amount of acids and ash. The glucose ratio shows a steady increase throughout the experiment, showing a marked inversion of sucrose. The purities show a decided increase at first, owing to the rapid coagulation of the albuminoids and gums and then a gradual falling off as the process of inversion continues.

In discussing the various clarifications by chemical means, the numerous processes have for convenience of description been divided into two general classes, *Alkaline Clarification,* where the juice is first treated with milk of lime, and *Acid Clarification,* where the juice is first acidified with sulphurous or phosphoric acid. In a properly regulated clarification the juice is of course brought back to neutrality before boiling, so that the above classification refers only to the preliminary treatment of the juice and not to its condition after clarification.

Alkaline Clarifications.

ALKALINE CLARIFICATION WITH LIME ALONE.

Lime has been used from the very earliest times for the clarification of cane juices and for cheapness, availability, and general excellence no other clarifying agent has been found to take its place. The first action of lime when added to cane juice consists in neutralizing the organic acids. If heat is then applied no inversion of sucrose takes place; the albumin of the juice is coagulated, the sulphates and phosphates are thrown down as insoluble lime salts, and the bases, iron and alumina, precipitated. The separation of these impurities also exerts a mechanical purification, the fat and wax, fiber, particles of soil, and a portion of the gums being removed by the formation of the flocculent precipitate. The precipitate produced by lime and heat collects into two portions—the one containing a greater part of the lighter bodies, such as wax and fiber, rising to the surface where it forms the blanket or scum, and the other part, comprising more of the heavier substances, dirt, lime, sulphate, etc., forms the settlings.

The approximate composition of the scums and settlings can be seen from the following analyses by Beeson:

	Ash.	Albuminoids.	Fat, wax, fiber, acids, gums, etc.
Scums	21.9	18.9	59.2
Settlings	23.7	15.6	60.7

An excess of lime in clarification is to be avoided. Any amount beyond what is required for the neutralization of the acids and the precipitation of impurities exerts a destructive action upon other constituents of the juice. The reducing sugars are especially attacked being converted into soluble lime compounds such as the glucinate of lime, the dark color of which injures the appearance of the syrup and final products. These lime salts also increase the viscosity of the juice thus retarding the work of evaporation. The removal of lime from these salts by mineral acids such as phosphoric has been proposed, but this does not result in the reformation of glucose. Instead the glucinic acid is liberated and remains in solution, retaining its dark color and other injurious properties. An excess of lime also acts upon certain of the amids converting the asparagin into aspartic acid and ammonia, which escaping into the air accounts for the smell of ammonia occasionally noticeable around clarifiers. The excess of lime may also act upon some of the precipitated albuminoids giving rise to various amido and fatty acids with the liberation of some ammonia. The glucinate of lime has itself an action similar to that of free lime, so that clarified juices weakly alkaline to begin with may in the syrup show a slight acidity owing to the formation of acid products during boiling.

A large number of experiments showing the action of heat and different amounts of lime upon cane juice were carried out at Audubon Park in 1898. The following examples showing the effects of an acid, a neutral and an alkaline clarification with lime; are cited. The samples for analysis were taken from the same clarifier before and after clarification. All results were calculated to the same sucrose content for comparison.

Experiment I.

Juice had an acidity of 1.6 cubic centimeters, and lime added till .55 cubic centimeter acidity remained, requiring .0384 ounce of lime per gallon.

TABLE XXI.

MILL JUICE.

Acidity in cubic centimeters	1.600
Brix	14.610
Sucrose	12.000
Glucose	1.140
Solids not sugar	1.470
Purity	82.130
Glucose ratio	9.500
Proteids	.179
Albuminoids	.083
Amids	.096
Alcoholic precipitate	.181
Gums, etc	.074
Ash in alcoholic precipitate	25.300
Albuminoids in alcoholic precipitate	35.430

CLARIFIED JUICE.

Acidity in cubic centimeters	.550
Brix	14.460
Sucrose	12.000
Glucose	1.140
Solids not sugar	1.320
Purity	82.980
Glucose ratio	9.500
Proteids	.128
Albuminoids	.029
Amids	.099
Alcoholic precipitate	.107
Gums, etc	.048
Ash in alcoholic precipitate	46.870
Albuminoids in alcoholic precipitate	8.190

An increase in purity of .85 was caused by the removal of some of the solids not sugar. The sucrose and glucose were not affected. Of the impurities 28.4 per cent of the proteids, consisting entirely of albuminoids, were removed, the amids remained unchanged and 35 per cent of the gums were removed.

Experiment II.

Neutral clarification, mill juice with an acidity of 1.8 cubic centimeters, lime added to neutrality, required .068 ounce of lime to one gallon of juice.

TABLE XXII.

MILL JUICE.

Acidity	1.800
Brix	14.850
Sucrose	12.000
Glucose	1.460
Solids not sugar	1.390
Purity	80.800
Glucose ratio	12.170
Proteids	.138
Albuminoids	.069
Amids	.069
Alcoholic precipitate	.212
Gums, etc	.071
Ash in alcoholic precipitate	33.540
Albuminoids in alcoholic precipitate	34.350

CLARIFIED JUICE.

Acidity	.000
Brix	14.610
Sucrose	12.000
Glucose	1.450
Solids not sugar	1.150
Purity	82.130
Glucose ratio	12.090
Proteids	.086
Albuminoids	.013
Amids	073
Alcoholic precipitate	.099
Gums, etc	.058
Ash in alcoholic precipitate	29.090
Albuminoids in alcoholic precipitate	12.750

An increase in purity of 1.33 is noted. The glucose is not affected, but there is a decrease in the brix and solids not sugar; 38 per cent of the proteids are removed consisting entirely of albuminoids, the amids remaining practically the same; 53 per cent of the alcoholic precipitate and 18 per cent of the gums are also removed.

Experiment V.

Juice limed to 3.3 cubic centimeters alkalinity, the acidity before liming being 1.9 cubic centimeters, .1953 ounce of lime added per gallon of juice.

TABLE XXIII.

MILL JUICE.

Acidity	1.900
Alkalinity	———
Brix	14.280
Sucrose	12.000
Glucose	1.540
Solids not sugar	.740
Purity	84.030
Glucose ratio	12.530
Proteids	.133
Albuminoids	.056
Amids	.067
Alcoholic precipitate	.172
Gums, etc	.046
Ash in alcoholic precipitate	36.820
Albuminoids in alcoholic precipitate	39.000

CLARIFIED JUICE.

Acidity	———
Alkalinity	3.300
Brix	14.370
Sucrose	12.000
Glucose	1.210
Solids not sugar	1.160
Purity	83.510
Glucose ratio	10.080
Proteids	.084
Albuminoids	.017
Amids	.067
Alcoholic precipitate	.212
Gums, etc	.107
Ash in alcoholic precipitate	46.340
Albuminoids in alcoholic precipitate	3.120

There is a decrease of .52 in the purity and an increase of .42 in the solids not sugar, a destruction of 21.4 per cent of the glucose and a corresponding decrease in the glucose ratio. The increase of 56.8 per cent in the solids not sugar, notwithstanding the removal of 37 per cent of proteids, shows the deleterious results of excessive liming.

The percentage of amids remains the same, but this does not indicate that none of them were converted to organic acids, as strong alkalinity decomposes the albuminoids into amids and ammonia, and the amount of decomposed albuminoids in this instance formed enough amids to equal those decomposed by the lime. The gums increase 137 per cent, while the alcoholic precipitate increases 23 per cent. The large increase in the gums is due to the organic acids formed by the action of the excess of lime, and the comparatively small increase in the alcoholic precipitate is due largely to the removal of the albuminoids from the juice; the albuminoids in the alcoholic precipitate of the mill juice were 39 per cent, while those in the alcoholic precipitate of the clarified juice were only 3.12 per cent.

These experiments show conclusively that an excess of lime decomposes the glucose and amids to a considerable extent and forms acids of a gummy character, and when the lime is largely in excess, the amount of these acids formed is sufficient to increase the gums over 100 per cent, thus more than doubling the amount of the most objectionable impurities in the juice, and at the same time darkening it by their presence. Besides this, which of itself is sufficient to condemn liming to alkalinity, the excess of lime acting upon the albuminoids (which are largely removed by heat alone, though aided by the addition of lime) converts them into amids, which remain in the juice, and further acting on these amids, decomposes them into organic acids and ammonia. The results of both these actions bring back into solution impurities that have been removed and are decidedly disastrous in sugar manufacture.

By leaving the juice slightly acid there was no addition of impurities, but the amount removed was not as great as that in the neutral clarification. The gums, of which a larger quantity is removed in the acid clarification given here than in the neutral clarification, were undoubtedly those obtained from the cane by light pressure as in the neutral clarification, lime not acting on these as strongly as on those removed by increasing the pressure.

The best method to clarify with lime alone is to add lime either to neutrality or slight acidity.

The method of clarification has necessarily a great deal to do with the composition of the after-products. An experiment made at Audubon Park in 1904, where lime only was used for clarification, showed the results tabulated in Table XXIV.

The work confirms the results previously reported. Ten per cent of the mineral matter of the juice is removed. The clarified juice and syrup show a marked acidity, notwithstanding that the raw juice was previously neutralized; this is undoubtedly due to the formation of acid decomposition products of the albuminoids, a supposition borne out by the increase of the amids. This decomposition of albuminoids and increase in amids goes on continuously through the whole process of evaporation and boiling, the ratio of albuminoids to amids being one to three in the syrup, one to four in the first molasses and one to five in the second molasses. The formation of amids, etc., is even more marked than is indicated by this increase in ratio for there is a considerable loss of nitrogen especially in the last stage of the process. In a number of experiments from both alkaline and acid clarification it was found that in boiling the second molasses to masse cuite there was a loss of 15 per cent of the total nitrogen. It was not determined in just what form this nitrogen escaped. It may have been in the form of ammonia or perhaps even in the form of gaseous nitrogen.

ALKALINE CLARIFICATION WITH LIME AND PHOSPHORIC ACID.

In the following experiment performed at Audubon Park in 1904, the juice was treated with a slight excess of lime and then after heating and skimming the greater part of the excess of lime was removed with phosphoric acid:

TABLE XXIV.

Juice 1.2° C. C. Acid.

Limed to Neutrality. Mixed Varieties of Cane.

	Total Solids	Sucrose	Dextrose	Levulose	Purity	Glucose Ratio	Ash	Free Acid	Combined Acid	Gums	Album-inoids	Amids
Raw Juice	14.55	11.47	0.98	1.08	78.83	17.96	0.40	0.15	0.12	0.15	0.097	0.085
Clarified Juice	14.63	11.54	0.97	1.03	78.88	17.33	0.36	0.06	0.15	0.17	0.034	0.104
Syrup	50.00	39.29	3.64	3.41	78.59	17.94	1.37	0.11	0.55	0.42	0.145	0 350
First Masse Cuite	90.00	74.05	6.17	6.22	82 28	16.74	2.34				0.218	0.611
First Sugar		93.60	3.14									
First Molasses	80.00	46.07	11.87	11.98	57.58	51.80	4.90				0.362	1.275
Second Masse Cuite	90.00	51.64	12.75	14.05	57.37	51 90	5.40				0.376	1.446
Second Sugar		88.45	4.26									
Second Molasses	80.00	31.26	15.46	17.04	39.07	104.0	7.04				0.399	1.893
Third Masse Cuite	90.00	33.26	15.71	17.91	36.96	101.1					2.152	

The excess of lime resulted in a destruction of over 15 per cent reducing sugars with a corresponding increase in the percentage of gums and combined acids. The action of lime seems to have continued as long as the products of the juice were worked in the sugar house, as it will be noted that there is a marked falling off in the glucose ratio with each boiling.

The concentration of mineral matter in the final products resulted in the precipitation of much calcium phosphate, causing a marked turbidity in the final molasses, and giving rise to a large amount of insoluble mineral matter in the third sugars (not reported in the table).

The excess of lime resulted in the destruction of a larger amount of albuminoids than in the preceding experiment with a corresponding increase in the albuminoid-amid ratio between the syrup and final molasses.

A striking fact in connection with this and the other clarification experiments, is the change which takes place in the ratio of dextrose to levulose during the process of manufacture. The dextrose which was in excess in the raw juice is practically equal to the levulose percentage in the first molasses, but in the second masse cuite resulting from this same molasses the dextrose is much lower than the levulose and this difference is even more pronounced in the final molasses.

It must of course be remarked that our methods of estimating dextrose and levulose in such a complex medium as molasses fall considerably short of perfection; nevertheless the results plainly indicate a greater preponderance of levorotatory substances in the last sugar house products, showing either a formation of new left-rotating substances, or a transformation of a part of the dextrose into bodies which polarize less to the right. The latter alternative is extremely probable for it is a well known fact that the various reducing sugars, dextrose, levulose, and mannose are readily convertible into one another by the action of lime and many of its compounds. Such a reaction is in fact very marked in an alkaline clarification of cane juice, as by carbonation, and as a consequence the molasses from such juice, as Pellet has shown, contains reducing sugars which were not originally present, such as mannose and glucose.

The extreme sensitiveness of dextrose and levulose to molecular changes in the presence of the merest trace of alkali may be nicely shown by boiling a solution of either sugar in a glass flask for several hours. The alkali dissolved from the glass is sufficient to effect the transformation of a considerable amount of one sugar into the other. Experiments upon the transmutation of sugars usually show a more rapid tendency upon the part of dextrose to pass into levulose than the reverse, and the excess of levulose in low grade cane products may be satisfactorily explained upon this assumption.

ALKALINE CLARIFICATION WITH LIME AND SULPHUROUS ACID.

In this experiment, the juice, after liming to 1 cc. alkalinity, was heated and skimmed; it was then brought back with sulphurous acid to .2 cc. acidity. The remainder of the process of clarification being conducted in the usual way.

As in the previous experiments, when an excess of lime was used, we note a falling off in the glucose content of the clarified juice and an increase in the combined acids and gums. The increase in glucose ratio of the syrup and continued decrease in purity indicate a slight inversion during boiling.

TABLE XXV.

Limed to 1 cc. alkalinity, heated and skimmed.
Sulphured to .2 cc. acidity.

Plant Cane. D. *74.

	Total Solids	Sucrose	Dex-trose	Levu-lose	Purity	Glucose Ratio	Ash	Free Acid	Com-bined Acid	Gums	Album-inoids	Amids
Raw Juice	16.12	13.62	0.60	0.59	84.49	8.73	0.48	0.09	0.12	0.09	0.096	0.150
Clarified Juice	16.24	13.65	0.60	0.52	84.05	8.20	0.48	0.02	0.19	0.24	0.023	0.152
Syrup	50.00	41.67	1.79	2.01	83.34	9.12	1.53	0.11	0.73	0.77	0.093	0.498
First Massecuite	90.00	77.38	3.43	3.49	(85.98)	6.66	2.76				0.172	0.875
First Sugar		96.00	1.54									
First Molasses	80.00	52.42	6.64	7.41	65.52	26.80	6.39				0.287	1.775
Second Massecuite	90.00	59.55	8.01	8.77	66.17	28.18	7.10				0.262	2.251
Second Sugar		86.61	1.96	2.10								
Second Molasses	80.00	41.14	9.33	10.60	51.42	48.44	9.63				0.355	2.834

ALKALINE CLARIFICATION WITH LIME AND CARBONIC ACID.

Carbonation, as alkaline clarification with lime and carbonic acid is termed, has been applied to the manufacture of sugar from beets with much success, and to a limited extent with sugar canes from tropical countries where the glucose content of the juice is very small.

The comparative immaturity of our sugar canes in Louisiana, and their correspondingly high glucose content, has, as was previously shown, not permitted the economical use of large quantities of lime at the temperatures ordinarily employed.

To this end, a reduction of the temperature and a large increase in the amount of lime was employed. The excess of lime was removed by carbonic acid, sulphurous acid or phosphoric acid in various manners.

The following tables give the methods of conducting the experiments and their results. In all of these the results were calculated to a basis of 12 per cent of sucrose for uniformity in comparison:

TABLE

CARBONATATION EXPERIMENT	Number	Cubic Centimeters Acidity	Cubic Centimeters Alkalinity	Brix	Total Solids	Sucrose	Glucose	Solids Not Sugar	Coefficient of Purity	Glucose Ratio
CLARIFIER No. 6—										
Mill juice	1	1.05	......	15.96	15.78	12.00	2.03	1.93	75.19	16.93
Juice limed and heated to 60-68° C.........	2	......	7.90	15.79	14.55	12.00	0.92	2.87	75.97	7.67
Juice limed as in No. 2, carbonic acid passed in, then heated to 90° C. and filtered	3	.....	0.55	15.28	14.48	12.00	0.86	2.42	78.55	7.17
Juice treated as above, then phosphoric acid added to acidity......	4	0.45	.....	15.02	14.68	12.00	0.83	2.19	79.89	6.92
CLARIFIER No. 7—										
Mill juice	5	1.00	.. ...	16.18	15.78	12.00	2.07	2.11	74.16	17.25
Juice limed and heated to 56° C. then filtered	6	......	21.30	17.65	16.29	12.00	0.72	4.93	67.99	6.00
Juice limed as above, carbonic acid passed in, heated to 90° C. and filtered	7	......	1.60	15.47	14.23	12.00	0.52	2.95	77.56	4.33
Final clarification of No. 7	8	......	0.25	15.12	14.12	12.00	0.36	2.76	79.37	3.00
CLARIFIER No. 8—										
Mill juice	9	1.10	. ...	15.67	15.27	12.00	1.64	2.03	76.58	13.67
Limed, carbonated and filtered Clarifier No. 8. Lime equivalent to 0.75 % of weight of cane added...........	10	......	1.40	14.85	14.24	12.00	0.43	2.42	80.81	3.58
Clarified Juice, Clarifier No. 8—Second carbonatation...........	11	....	0.15	14.98	13.83	12.00	0.72	2.26	80.11	6.00
Syrup of carbonatation Experiments diluted and reclarified with phosphoric acid—phosphoric acid added to 2.2 cc. acidity and limed.............	12	0.60	......	15.54	15.24	12.00	0.76	1.78	77.22	6.33
Mill juice	13	2.50	.....	17.55	17.00	12.00	3.87	1.68	68.38	32.25
Limed juice	14	......	5.30	16.68	16.11	12.00	2.04	2.64	71.94	17.00
Limed juice after carbonatation	15	...	0.20	16.70	16.06	12.00	2.48	2.22	71.86	20.67
Juice decanted, boiled and skimmed.........	16	......	0.20	16.44	15.76	.2.00	2.03	2.41	72.99	16.92

XXVI.

Total Proteids	Albuminoids	Amids	Ash	Lime	Alcoholic Precipitate	Albuminoids in Alcoholic Precipitate	Ash in Alcoholic Precipitate	Lime in Alcoholic Precipitate	Gums, etc.	Phosphoric Acid in Alcoholic Precipitate	Phosphoric Acid in Juice	Sulphurous Acid	Sulphuric Acid
.2690	.1356	.1334	.3610	.0300	.4940	.1340	.1170	.0170	.2430	......	......	.....	....
.1673	.0356	.1217	.7700	.4730	1.3570	.0560	.4950	.1560	.8060	.....	......	....	....
.1293	.0350	.0943	.5200	.2520	.5250	.0504	.1930	.1360	.2816	......	......	.....	....
.1902	.0310	.1592	.4970	.2230	.3337	.0275	.1736	.0947	.1336	.....	......	......	....
.2905	.1485	.1420	.3680	.0420	.3906	.1350	.1138	.0156	.1418	......	.....	......	....
.1669	.0639	.1030	1.7350	1.1110	2.0402	.0785	.8037	.5661	1.1580	....	......	......	....
.1328	.0247	.1081	.6190	.3510	.5283	.0250	.1974	.1381	.3059	...	......	......	....
.1356	.0192	.1164	.6080	.3340	.4028	.0213	.1265	.1021	.2550	......	....	......	....
.2634	.1491	.1143	.4960	.0290	.4524	.1311	.1205	.0116	.2008	......	...	......	....
.1431	.0318	.1113	.5090	.2500	.5595	.0153	.2319	.1729	.3123	......	....	.....	....
.1175	.0241	.0934	.5530	.2430	.3540	.0180	.1290	.0750	.2070	.....	....	......	....
.1694	.0239	.1355	.6470	.2960	.3718	.0254	.1376	.....	.2088	......	......	......	....
.3579	.1845	.1734	.4610	.0910	.5122	.1300	.0715	.0910	.3107	......	......	.....	....
.2318	.0428	.1890	.7360	.3830	.8337	.0408	.3515	.2619	.4914	......	....	......	....
.2330	.0430	.1900	.0437	.0410	.2755	.0154	.0701	.0520	.1900	....	......	......	....
.1943	.0428	.1515	.4810	.0790	.2346	.0162	.0510	.0372	.1676	.....	....	......	....

TABLE XXVI.

CARBONATATION EXPERIMENT	Number	Cubic Centimeters Acidity	Cubic Centimeters Alkalinity	Brix	Total Solids	Sucrose	Glucose	Solids Not Sugar	Coefficient of Purity	Glucose Ratio
CLARIFIER No. 8—*Continued.*										
Syrup from decanted juice. boiled and skimmed..............	17	0.35	......	15.96	15.20	12.00	2.05	1.91	75.19	17.08
Juice boiled with settlings	18	0.55	.. ..	16.78	16.36	12.00	2.33	2.45	71.52	19.42
Mill juice...............	19	1.40	.....	15.92	15.19	12.00	2.23	1.69	75.38	18.58
Limed juice before heating. Alkalinity with precipitate 24.0 cc. Without precipitate 21.4 cc.......	20	.....	21.50	17.48	16.52	12.00	1.99	3.49	68.65	18.42
Limed juice heated to 56° C	21	.....	16.10	17.48	17.04	12.00	0.90	4.58	68.65	7.50
Phosphoric acid added to juice heated to 56° C. to 0.2 cc. acidity before heating......	22	0.10	......	15.55	15.02	12.00	1.55	2.00	77.17	12.92
Juice of No. 21 carbonated in excess of lime	23	0.35	......	16.20	15.57	12.00	1.63	2.57	74.07	13.58
Juice of No. 21 carbonated to 2 cc. alkalinity, heated to 85° C, filtered and juice was found to be .5 cc. acid	24	0.50	......	16.28	15.54	12.00	0.68	3.60	73.71	5.67
Juice of No. 21 sulphured to .5 cc. alkalinity, heated to 85° C, filtered and sulphured till slightly acid, heated to boiling and filtered.............	25	0.50	......	16.68	15.56	12.00	0.60	4.08	71.35	5.00
Mill juice...............	26	1.20	. ...	15.90	15.61	12.00	1.98	1.92	75.47	16.50
Juice limed to 22.1 cc. alkalinity and heated and heated to 30° C..	27	......	19.80	17.28	15.58	12.00	1.69	3.59	69.45	14.08
Juice limed to 22.1 cc. alkalinity and heated to 40° C.	28	......	18.80	17.29	15.53	12.00	1.64	3.65	69.40	13.67
Juice limed to 22.1 cc. alkalinity and heated to 50° C.	29	.. ..	18.00	17.39	15.74	12.00	1.49	3.90	69.01	12.42
Juice limed to 22.1 cc. alkalinity and heated to 60° C.	30	......	15.20	17.07	15.52	12.00	1.07	4.00	70.30	8.92
Juice limed to 22.1 cc. alkalinity and heated to 70° C.	31	.... ..	12.80	17.22	15.84	12.00	0.70	4.52	69.69	5.83
Mill juice	32	1.45	.....	16.72	16.57	12.00	2.42	2.15	71.77	20.17

—Continued.

Total Proteids	Albuminoids	Amids	Ash	Lime	Alcoholic Precipitate	Albuminoids in Alcoholic Precipitate	Ash in Alcoholic Precipitate	Lime in Alcoholic Precipitate	Gums, etc.	Phosphoric Acid in Alcoholic Precipitate	Phosphoric Acid in Juice	Sulphurous Acid	Sulphuric Acid
.2241	.0388	.1853	.4980	.0910	.2556	.0160	.0546	.0381	.1894	......	....	.. ..	....
.2159	.0412	.1747	.4880	.0850	.2775	.0103	.0435	.0329	.2237	......	......	......	....
.2710	.1127	.1583	.3726	.0379	.2526	.1105	.6310	.0113	.0790	.0077	.0404	......	....
.2254	.0792	.1462	1.6584	.8744	2.4904	.0712	.6752	.6146	1.7440	......	......	......	....
.1774	.0596	.1178	1.6977	.8895	2.7269	.0695	.6830	.6109	1.9744	......	... ..	......	....
.1406	.0390	.1167	.5909	.1990	.0945	.0348	.0323	.0162	.0274	......	.1120	...	....
.1603	.0336	.1267	.6588	.1980	.2076	.0204	.0540	.0442	.1332	.....	.0246	....	....
.1613	.0374	.1239	.6580	.2390	.2730	.0291	.0741	.0638	.1698	......	......	.....	....
.1521	.0115	.1406	.7242	.3024	.2424	.0188	.0688	.0552	.1548	.0031	.0092	.0768	.1536
.2318	.1168	.1150	.2751	.0339	.1528	.0953	.0429	.0124	.0136	... ..	......	......	....
.1930	.0745	.1185	.9200	.7293	1.9300	.0705	.5374	.4420	1.3221	.....	......	......	....
.1595	.0614	.0981	.8722	.7053	2.1394	.0511	.6138	.4229	1.4745	... ..	......	......	....
.1738	.0668	.1070	.9200	.7293	2.0039	.0449	.6552	.5475	1.3038	......	....	......	....
.1515	.0539	.0976	.9138	.7156	1.7661	.0539	.5197	.3809	1.1915	......	....	......	....
.1601	.0555	.1046	1.1288	.7088	1.4776	.0556	.4628	.4040	.9592	.. ..	......	......	....
.2275	.1151	.1124	.2557	.0485	.2457	.0510	.0412	.0036	.1535	......	.....	.. ..	....

TABLE XXVI.

CARBONATATION EXPERIMENT	Number	Cubic Centimeters Acidity	Cubic Centimeters Alkalinity	Brix	Total Solids	Sucrose	Glucose	Solids Not Sugar	Coefficient of Purity	Glucose Ratio
CLARIFIER No. 8—*Continued.*										
Juice limed to 20 cc. alkalinity and heated to 40° C......	33	......	17.80	17.94	16.40	12.00	1.88	4.06	66.95	15.67
Juice limed to 20 cc. alkalinity and heated to 45° C........... ..	34	......	16.40	17.85	16.11	12.00	1.75	4.10	67.23	14.58
Juice limed to 20 cc. alkalinity and heated to 50° C...............	35	......	16.80	17.76	15.60	12.00	1.63	4.13	67.57	13.58
Juice limed to 20 cc. alkalinity and heated to 55° C...............	36	.....	17.40	18.27	16.49	12.00	1.43	4.84	65.68	11.75
Mill juice	37	2.30	......	21.62	21.09	12.00	5.09	4.53	55.50	42.42
Juice sulphured to 7.3 cc. acidity and limed to .05 cc. alkalinity	38	......	0.05	20.92	20.24	12.00	4.59	4.33	57.37	38 25
Juice limed to 10.5 cc. alkalinity, heated to 45° C. and sulphured to 0.4 cc. alkalinity...	39	......	0.40	19.58	18.37	12.00	3.84	3.74	61.24	32.00
Juice limed to 10.5 cc. alkalinity, heated to 45° C. and phosphoric acid added............	40	.....	0.40	19.46	18.88	12.00	3.84	3.62	61.66	32.00
Juice limed to 10.5 cc. alkalinity, heated to 45° C, carbonated and filtered, then heated to 95° C	41	......	0.35	20.20	18.78	12.00	3.78	4.42	59.41	31.50

—Continued.

Total Proteids	Albuminoids	Amids	Ash	Lime	Alcoholic Precipitate	Albuminoids in Alcoholic Precipitate	Ash in Alcoholic Precipitate	Lime in Alcoholic Precipitate	Gums, etc.	Phosphoric Acid in Alcoholic Precipitate	Phosphoric Acid in Juice	Sulphurous Acid	Sulphuric Acid
.1986	.0704	.1182	1.7595	1.1662	2.1348	.0720	.7128	.6288	1.3500	......	.....	.... .	....
.1477	.0752	.0725	.9373	......	2.7227	.0752	.7015	.5853	1.9460	... ..	......	. ....	....
.1710	.0640	.1070	1.0090	.8269	2.6860	.0635	.6760	.5880	1.9465	. ..	. . ..	. ....	....
.1725	.0735	.0990	1.3242	.9166	2.6797	.0735	.7200	.5101	1.8862	......	.....	......	....
.4000	.2165	.1835	.5090	......	1.2362	.1024	.1483	.0214	.9855	......	.....	... ..	....
.3834	.1211	.2623	.6280	.1230	.8170	0750	.1800	.0980	.5620	......	. . ..	. ....	....
.3666	.0887	.2779	.5095	.1019	.7670	.0610	.0885	.0670	.6175	......	......	......	....
.3279	.0893	.2486	.4875	.1035	.5530	.0218	.0994	.0574	.4318	.....	......	......	....
......	.0997	......	.4949	.0841	.7295	.0526	.0841	.0447	.5928	.....	......	......	....

On examining the above tables, it will be noted that there are several stages in each clarification showing the action of the clarifying agents at these points. Numbers 1 to 4, inclusive, which are the results of liming strongly and single carbonating, show the action of the excess of lime. Carbonic acid precipitates the lime in No. 3, while No. 4 is the result of the substitution of phosphoric acid for carbonic acid. From an ordinary analysis including total solids, sucrose and glucose, all results show marked improvement over the mill juice. It is noted, however, that in all except the phosphoric acid clarification, there is an excess of gums, etc., in the clarified over the raw juice. In the phosphoric acid clarification where nearly fifty per cent of the gums of the mill juice are removed, a large amount of combined lime remains, which was found to prevent the concentration of the juice in the vacuum pan. Examining 5 to 8, embracing one clarification with double carbonating to remove the excess of lime, an improvement over the limed juice as in the preceding single carbonation is noted, but even the final clarification shows these juices to contain more impurities than are in the mill juice.

Here, during the time the lime was in large excess, the temperature was not above 68° Centigrade. Notwithstanding this fact, the injury was due to the action of this excess of lime on the glucose. This is shown by the destruction of glucose and the large increase in the amount of gums. The same deleterious results are noted throughout the tables, the excess of lime so injuring the character of the juice that it could not by any practical means be brought into such a condition as to render it fit for manufacturing purposes.

Further examination of the tables, Nos. 19 to 25, inclusive, shows a combination of the uses of lime, sulphur, phosphoric and carbonic acids in an attempt to overcome, if possible, the evil of the action of the lime at low temperatures. A close perusal of the results will show that while these agents removed a considerable quantity of impurities, in no instance was even the purity increased. The glucose shows considerable variation. The result of heating the alkaline juice and the quantity of lime remaining is evidence that the lime combined with organic acids. This is fully shown by the large increase in the amount of gums, acids, etc., as well as by the fact that the clarified juices are only slightly acid and this acidity is not sufficiently great to account for the large quantity of organic acids remaining in solution. Phosphoric acid, No. 22, gave the best clarification, and the clarified juice is left nearly neutral (0.1 cubic centimeter acid), but in this the unusually large amount of lime remaining in solution combined with organic acids, hinders evaporation and crystallization.

Numbers 26 to 31, inclusive, give the mill juice compared with the juice limed cold to 22.1 cubic centimeters alkalinity, then heated at ranges of 10° Centigrade, starting at 30° Centigrade and ending at 70° Centigrade. The alkalinity decreases as the temperature increases. The purity of all clarifications is considerably reduced when determined by the Brix, but the true purity determined by the actual total solids varies very little from that of the mill juice. The glucose decreases with the elevation of the temperature, and the solids not sugar increase. The albuminoids decrease, being broken up in the 40°, 50°, 60° and 70° Centigrade clarifications into amids which by the strong alkalinity and high temperature are partially converted into ammonia and amido acids; the total amids, however, remain the same. The ash shows very little fluctuation, as does the lime remaining in solution. The gums increase in quantity up to 40° Centigrade, then decrease from the maximum as the temperature is raised, as the action of the increasing temperature changes their composition.

Taking the comparison as a whole, the alkalinity was less injurious at 30° to 40° Centigrade than at the other temperatures. At this point its action on the glucose and amids is the least destructive and it forms the smallest amount of salts of organic acids, which are more objectionable than the original compounds.

Numbers 32 to 36 compare the same clarification with a large quantity of lime alone (20 cubic centimeters alkalinity), at ranges of 5° in temperature for the clarification.

Comparing these, it will be noticed that No. 33 gave the best results and the temperature here was 40° Centigrade, confirming previous results, where 30° to 40° was found most beneficial. Numbers 37 to 41, inclusive, are clarifications of a fermented juice by treating with sulphur followed by liming to practical neutrality. The lime was followed by sulphur in No. 39, by phosphoric acid in No. 40, and by carbonic acid in No. 41. Here in No. 40 it is seen that phosphoric acid, followed by sulphurous acid, gives the best clarification, but in none of these clarifications can any marked improvement in the clarified juice be noted, while the large amount of lime remaining in solution is very objectionable.

None of these strongly alkaline clarifications at low temperatures were found as beneficial as the methods at present adopted in the sugar houses. The excess of lime, except where heat was only 30° to 40° Centigrade (and unfortunately this clarification was not completed), in every instance attacked the glucose strongly, and the products formed were very injurious. Where concentration was attempted it was found to darken the juice considerably, while in attempting to evaporate to masse cuite the lime salts coated the coils and so retarded the circulation of heat that evaporation beyond a thick syrup was impossible.

Noting the injuries caused by the use of lime in large quantities, even at low temperatures, and the inefficiency of either carbonic, sulphurous or phosphoric acids in correcting these injuries, it was thought that by using a smaller excess of lime more satisfactory results could be obtained.

The following table shows the result of the sulphur and lime clarifications, the juice while alkaline being heated to 55° Centigrade, instead of 99°, as in ordinary clarifications:

TABLE XXVII.

	Acidity	Alkalinity	Brix	Total Solids	Sucrose	Glucose	Solids Not Sugar	Coefficient of Purity	Glucose Ratio	Total Proteids	Albuminoids	Amids	Ash	Lime	Sulphurous Acid (SO_2)	Sulphuric Acid (SO_3)	Alcohol Precipitate	Albuminoids in Alcohol Precipitate	Ash in Alcohol Precipitate	Lime in Alcohol Precipitate	Gums, etc.
Mill Juice, Clarifier No. 51.	1.45	....	16.58	15.91	12.00	2.00	2.58	71.22	16.67	.4006	.1624	.2382	.485	.061	......	......	.3367	.1488	.1105	.0126	.0774
Limed Juice, Clarifier No. 51—Lime added and heated to 55° C...............	....	2.9	16.52	16.35	12.00	2.20	2.32	72.63	18.33	.2681	.0564	.2117	.597	.196	......	.....	.5595	.0356	.2328	.1592	.2911
Limed Juice, Clarifier No. 51—Sulphured to acidity and clarified. During sulphuring the temperature rose to 78° C.........	1.05	....	16.43	15.86	12.00	2.05	2.38	73.04	17.08	.2494	.0472	.2022	.609	.149	.060	lost	.2570	.0197	.0992	.0552	.1381

These results show that even at this low temperature, with lime in excess (2.9 cubic centimeters alkalinity), the glucose was not attacked as in the clarifications where higher temperature was employed. The purity increased 1.41 per cent by Brix, and to a larger extent by the actual solids. The amids, however, were attacked and the gums largely increased over those in the mill juice. The sulphuring of this juice to acidity (1.05 cubic centimeters), while removing a considerable quantity of the impurities, did not give as pure a juice as that started with, and this method of clarification must therefore be condemned.

The results of the substitution of phosphoric acid for sulphurous acid, then varying the alkalinity and the amount of phosphoric acid added, are given in Table XXVIII.

On examining Table XXVIII it was found that phosphoric acid proved to be very beneficial in its results. The final clarifications, both when phosphoric acid was added to slight acidity and when the juice was left slightly alkaline, showed very good results.

The action of lime alone at the temperature of 55° to 57° Centigrade shows the same effects as those found in all strongly alkaline clarifications. The glucose is attacked, gums, etc., are increased, and the ash and lime which remain in the juice are also increased. The action of phosphoric acid on this partially clarified juice is very beneficial. Without the application of heat it gives a large increase in purity, restoring the glucose to nearly its original percentage. It further removes the albuminoids and largely removes the gums, the amount of gums remaining in this juice being considerably less than in the mill juice. Continuing with this clarification by heating No. 3 until the conditions of normal clarification are reached, the benefit of the phosphoric acid is still maintained, though a very small amount of ash, gums, etc., is brought into solution. The purity is apparently lowered, but if the true total solids be examined, it is increased. No. 5 is the clarified product from the same mill juice; in which phosphoric acid has been added in quantity not sufficient to neutralize the lime. The excess in the previous clarification was only a trace (.05 cubic centimeter acidity). Here the clarified juice was left slightly alkaline, the alkalinity being .1 cubic centimeter. In this clarification the glucose was not attacked to an

TABLE XXVIII.

	Number	Acidity	Alkalinity	Brix	Total Solids	Sucrose	Glucose	Solids Not Sugar	Coefficient of Purity	Glucose Ratio	Total Proteids	Albuminoids	Amids	Ash	Lime	Phosphoric Acid ($P_2 O_3$)	Alcoholic Precipitate	Albuminoids in Alcohol Precipitate	Ash in Alcohol Precipitate	Lime in Alcohol Precipitate	Gums, etc.
Raw Juice................	1	1.05	....	16.70	16.21	12.00	2.49	2.21	71.86	20.75	.3220	.1452	.1768	.4066	.0377	.0269	.3846	.1169	.1835	.0226	.0842
Limed Juice, 20 lbs. lime added to 350 gallons of juice and heated to 55-57° C.	2	....	6.30	17.55	16.47	12.00	1.85	3.70	68.38	15.42	.2062	.0454	.1608	.813	.436	......	1.0635	.0408	.8975	.2827	.1252
Clarified Juice, Phosphoric Acid—added to slight acidity before heating.	3	0.05	....	15.21	14.95	12.00	1.97	1.24	78.89	16.42	.1790	.0325	.1465	.365	.048	.008	.0480	.0029	.0180	.0072	.0271
Clarified Juice—After heating	4	0.05	.. .	15.44	14.84	12.00	1.92	1.52	77.72	16.00	.1801	.0276	.1525	.389	.042	.007	.0648	.0031	.0300	.0144	.0317
Clarified Juice, Clarifier No. 37—Mill juice treated as in No. 36....	5	....	0.10	15.39	14.99	12.00	2.40	0.99	77.97	20.00	.1650	.0268	.1382	.363	.090	.005	.0163	.0011	.0110	.0034	.0042

appreciable extent, while the purity was raised to about the same as that in the acid clarification (No. 4). The gums were removed in greater amount, the total alcoholic precipitate being less than the gums which remained in the alkaline clarification. The gums, etc., are almost all removed from the clarified juice (No. 5), only .0042 per cent remaining.

This shows that by employing a low temperature with a moderate amount of lime, as compared to carbonatation, or a large excess as compared with normal clarifications, then removing this excess by phosphoric acid, a very large part of the impurities are removed and the results are beneficial.

ACID CLARIFICATION.

In the previously discussed chemical clarifications, the juices were treated with lime to the points of neutrality or alkalinity before beginning the removal of impurities. We will now take up a series of clarifications of an exactly opposite type, where the juice is first acidified with either phosphoric or sulphurous acids.

The great danger of an alkaline clarification consists in the formation of gums and other melassegenic products. An equally great risk—that of the inversion of sucrose—is incurred in an improperly conducted acid clarification. The beautiful clarification which a liberal use of phosphoric or sulphurous acids effect is well known to every sugar maker. Bright, limpid juices are obtained which are free from gums and which can be evaporated and boiled with the greatest ease, yielding masse cuites which give a prime quality of first sugars with no difficulty in purging. When sulphitation was first introduced in Louisiana, the careless sugar maker was frequently content with this apparent smoothness of operations, and paid no attention to the excessive losses of sucrose, which resulted in yields as low as 90 pounds of sugar per ton of cane.

ACID CLARIFICATION WITH PHOSPHORIC ACID AND LIME.

This method is usually found to give very satisfactory results, but it is practiced in Louisiana to only a limited extent, the relatively high cost of phosphoric acid being the great obstacle in the extension of this process.

In the experiment, Table XXIX, the juice was acidified with phosphoric acid to five cubic centimeters N-10 acidity, and after bringing back with lime to 0.2 cubic centimeters acidity, was heated and worked in the usual way.

It will be noted that a higher degree of exhaustion is attained in the second molasses than is the case in any of the experiments with alkaline clarification. A slight inversion seems to have taken place in the boiling of the second masse cuite, as is indicated by the increase in glucose ratio and the decrease in purity. As regards the changes taking place in the ratio of dextrose to levulose and of albuminoids to amids during the process of manufacture, the same observations hold as were noted in previous experiments.

ACID CLARIFICATIONS WITH SULPHUROUS ACID AND LIME.

This method of clarification, known as sulphuration or sulphitation, is the one most commonly practiced in Louisiana, being used in over 80 per cent of the sugar houses. The general practice is to sulphur the juice to from 3 cubic centimeters to 5 cubic centimeters N-10 acidity for 10 cubic centimeters of juice; after bringing back with lime to faint acidity or neutrality the juice is heated until the blanket of impurities begins to break. It is then either skimmed and allowed to settle in the clarifier or else run into settling tanks, where the suspended impurities are allowed to deposit. Separating the juice from scums and sediment before settling is frequently practised, this being found to assist in the mechanical elimination of impurities. After leaving the settling tanks, which work automatically, the juice in some sugar houses in further purified by passing through bag filters.

SULPHUR IN COMBINATION WITH LIME AND HEAT AS CLARIFYING AGENTS.

Before entering into results of the use of sulphur in clarifying cane juice, a short statement of its properties will be given.

When sulphur is burned in the air it unites with oxygen, forming a gas called sulphur dioxide. This, on being forced into cane juice, combines with water to form sulphurous acid. One pound of sulphur forms two pounds of sulphur dioxide. Sulphur dioxide is quite soluble in cane juice, one gallon of juice at ordinary temperature and pressure dissolving 33 gallons of sul-

TABLE XXIX.

Run 7. Phosphoric Acid to 5cc. acidity.
Lime to .2cc. acidity.

Plant Cane. D. 74.

	Total Solids	Sucrose	Dex-trose	Levu-lose	Purity	Glucose Ratio	Ash	Free Acid	Com-bined Acid	Gums	Album-inoids	Amids
Raw Juice	15.49	12.85	0.74	0.65	82.85	10.82	0.45	0.08	0.12	0.13	0.097	0.127
Clarified Juice	15.21	12.77	0.65	0.58	83.96	9.63	0.44	0.02	0.16	0.13	0.025	0.124
Syrup	50.00	41.43	2.04	2.38	82.86	10.67	1.51	0.11	0.60	0.50	0.108	0.493
First Masse cuite	90.00	78.13	3.51	4.39	86.81	10.11	2.58				0.160	0.796
First Sugar		95.60	2.00									
First Molasses	80.00	51.40	7.11	7.56	64.25	28.54	5.43				0.249	1.621
Second Masse cuite	90.00	59.71	8.52	10.33	66.34	31.57	6.11				0.257	1.817
Second Sugar		81.89	2.88	3.57								
Second Molasses	80.00	32.45	11.37	13.38	40.56	76.28	7.40				0.324	2.580

phur dioxide, or the amount of sulphur dioxide formed from 6.33 ounces of sulphur. It is therefore possible to use 6.33 ounces of sulphur to every gallon of juice. This amount of sulphur dioxide, however, cannot be made to combine with the juice in ordinary sugar house work, as it is quite difficult to cause cane juice to absorb its full capacity of this gas. In practice it is difficult to use more than .2146 ounce of sulphur dioxide or .1073 ounce of sulphur per gallon of cane juice.

At high temperatures all sulphur acids invert cane sugar very strongly. In its inverting effects sulphurous acid ranks second among the sulphur acids, and fourth in the entire list of acids.

Experiments on the inverting power of sulphurous acid, as ordinarily used in clarification, showed that at the ordinary temperature no inversion took place when the juice was allowed to remain acid for a moderate time, but when heated to 150° Fahrenheit 23 per cent of the sucrose was inverted in one-half hour, and in one hour at 195° Fahrenheit practically all of the sucrose was inverted. The acidity of the juice was equivalent to a twentieth normal solution of sulphurous acid. Sulphur dioxide when absorbed by cane juice raises the density in proportion to the amount absorbed and shows a corresponding decrease in purity when the Brix spindle or saccharometer is used to estimate the solids. This, however, is only temporary, as on the addition of lime, sulphites of lime are formed, which are comparatively insoluble in the juice, and remove the sulphurous acid. Sulphurous acid also precipitates some of the albuminoids and exercises a bleaching effect on the coloring matters of the juice.

Before giving the results, a further explanation of the terms used and their equivalents will be given. The acidity or alkalinity of these juices is determined by means of a tenth (1-10) normal acid or alkali solution, using either lime, sodium or potassium hydrate as the alkali, with phenolphthalein as an indicator, and is expressed in terms of the number of cubic centimeters of solution required to neutralize 10 cubic centimeters of juice. One cubic centimeter acidity is equivalent to .02146 ounce of sulphur dioxide per gallon and one cubic centimeter alkalinity is equivalent to .0375 ounce of lime per gallon.

Table XXX shows the action of sulphurous acid, lime and heat in clarifying.

In this table it will be noticed that the sulphuring was carried to the same point in each clarification, the amount of lime added varying with each clarification, except in No. 9 and No. 11.

The sulphured juices show a decrease in purity when calculated on the degree Brix and even when calculated on the total solids, though in the latter case the differences are considerably less, except in one instance. This decrease is caused by the higher specific gravity of the sulphurous acid dissolved in the juice, and as most of this is driven off during evaporation, a lesser increase in total solids, when determined by this method, is noted.

In No. 1 to No. 3, inclusive, the analyses of the mill, sulphured and clarified juices are given. Clarification has also been made on a juice with a large quantity of the acids of the juice and some sulphurous acid left unneutralized by lime, the acidity being 3.0 cubic centimeters. In this experiment the purity of the clarified juice is not equal to that of the mill juice. The increase in glucose in the sulphured juice is due to the length of time it was allowed to remain so strongly acid (10 cubic centimeters) before the analysis was made. Not showing in the clarified juices, it is evident that the inversion did not take place before clarification. In this clarification there is very little variation in the solid and sugar contents of the mill and clarified juices. There is, as expected from the acidity of the juice, a considerable quantity of sulphur in the form of free sulphurous and sulphuric acids which remain, in the clarified juice. Seventy-four per cent and 74.6 per cent, respectively, of the gums, etc., and albuminoids are removed.

In the next clarification (Nos. 4 to 6, inclusive) sulphuring was carried on to the same point and the juice was limed until the acidity was reduced to 1 cubic centimeter. Quite an increase in purity is noted in the clarified juice when calculated on the Brix. This, however, is only apparent, due doubtless to mineral bodies, the specific gravities of whose solutions are higher than the specific gravities of sucrose solutions containing the same per cent of solid matter. By actual solids there is very little

TABLE XXX.

	Acidity	Alkalinity	Total Solids	Brix	Sucrose	Glucose	Solids Not Sugar	Purity Coefficient	Glucose Ratio	Sulphurous Acid	Sulphuric Acid	Lime	Ash	Total Proteids	Albuminoids	Amids	Alcohol Precipitate	Gums, etc., in Alcohol Precipitate	Ash in Alcohol Precipitate	Albuminoids in Alcohol Precipitate	Lime in Alcohol Precipitate
1. Mill juice	......	....	......	15.27	12.00	1.74	1.53	78.59	14.50	...	....	...	....	.208	.097	.111	.361	.213	.040	.108	....
2. Sulphured juice	10.00	....	.....	15.96	12.00	1.84	2.12	75.19	15.33	.312	.013	....	....	.219	.098	.121	.401	.226	.052	.123	.012
3. Clarified juice	3.00	...	.....	15.37	12.00	1.75	1.62	78.07	14.58	.079	.082	....	....	.138	.025	.113	.241	.054	.176	.011	.106
4. Mill juice	......	....	15.17	15.82	12.00	2.00	1.83	75.92	16.66	..	....	....	.578	.232	.126	.107	.270	.156	.022	.092	.003
5. Sulphured juice	10.00	....	15.34	16.14	12.00	2.04	2.10	74.32	17.00	.305	.090	....	.507	.232	.127	.105	.370	.226	.051	.093	.006
6. Clarified juice	1.00	....	15.32	15.55	12.00	2.02	1.53	77.17	16.84	.071	.095	.168	.403	.145	.026	.119	.057	.051	.003	.003	.001
7. Mill juice	......	....	14.38	15.12	12.00	1.44	1.68	79.36	12.00	....	....	....	.598	.188	.100	.088	.334	.227	.027	.080	.006
8. Sulphured juice	10.00	....	14.57	15.00	12.00	1.34	1.66	80.13	11.15	.203	.045	....	.633	.180	.100	.080	.341	.208	.048	.085	.017
9. Clarified juice	0.00	0.00	14.19	14.83	12.00	1.38	1.45	80.92	11.50	.058	.049	.048	.206	.104	.015	.089	.037	.032	.001	.004	.000
10. Mill juice	......	....	14.02	14.22	12.00	1.00	1.22	84.39	8.33	....	....	....	.336	.126	.084	.042	.279	.170	.034	.075	.003
11. Sulphured juice	10.00	...	13.93	14.40	12.00	1.05	1.35	83.33	8.75	.202	.000		.285	.120	.075	.045	.261	.167	.027	.067	.004
12. Clarified juice	0.00	0.00	14.07	14.16	12.00	1.02	1.14	84.75	8.50	.033	.020	.035	.225	.060	.014	.046	.039	.029	.002	.008	.000
13. Mill juice	......	....	15.23	15.61	12.00	1.74	1.87	76.87	14.50	....	....	....	.461	.309	.133	.176	.371	.185	.042	.044	.006
14. Sulphured juice	10.00	....	15.28	15.66	12.00	1.73	1.93	76.63	14.42	.250	.057	....	....	.280	.125	.155	.372	.163	.106	.103	.013
15. Clarified juice	.....	1.00	15.09	15.40	12.00	1.63	1.77	77.92	13.59	.046	.023	.052	.541	.223	.032	.190	.058	.044	.007	.007	.005

difference in purity. The sulphur salts remain in solution in large proportions, almost equaling those in the more strongly acid juice (No. 3). The amount of lime left in solution as lime salts is .168 per cent of the juice. Thirty and three-tenths per cent of the ash, 79.4 per cent of the albuminoids and 67.3 per cent of the gums, etc., present in the mill juice are removed. This, while not as large a percentage as in the clarification No. 3, leaves less gums in the juice on account of its being from purer cane, for, as noted under the results of juice extracted by the different mills (at different pressures), the more impure the juice the greater is the action of clarifying agents, both in quantity and percentage. Continuing the increase of lime to the neutral point, there are given the results of two clarifications, No. 9 and No. 12. In both instances an increase in purity is noted over that of the mill juice, the purer juice, as is expected, showing the smaller increase in purity. The salts of the sulphur acids are removed in larger quantity, and in No. 12 very little of such compounds remains in solution. The amount of lime remaining in solution is considerably reduced, being .168 in the 1. cubic centimeter acid clarification and .048 and .035 in the neutral clarifications. The amount, as well as the percentage, of ash removed is higher than in the previous clarifications, but here the more impure juice, No. 9, leads both in amount and percentage. Of the ash present in the mill juice, 64 per cent in No. 9 and 49.3 per cent in No. 12 is removed. The albuminoids removed are 85 per cent and 83.3 per cent, respectively, while the removal of the gums is 85.9 per cent and 82.9 per cent.

Here attention is again called to the benefits derived from a neutral clarification, as both the percentage and amount of impurities removed are largely in excess of the more acid clarifications. Both vary with the purity of the juice, for even in a very pure juice (purity 84%) the percentage of impurities removed is higher than in the clarifications that are allowed to remain acid. Continuing the addition of lime in No. 15 until the juice is made 1 cubic centimeter alkaline, there is an increase in purity again noted. The glucose, however, is slightly attacked and its amount reduced. The evil effects of this were mentioned under lime clarifications and are the same here. The sulphur acids and their salts remaining in solution are more than in the neutral clarification, but considerably less than the amount remaining in the acid clarification. The lime remaining in solution is, as would be expected, in larger quantity than that present in neutral clarifications, as its excess is the cause of the alkalinity. The ash, instead of decreasing, shows here an increase. Of the albuminoids, 75 per cent are removed. The amids here for the first time in this table show an increase, which, while slight, should be a reminder of the action of the excess of lime on both the albuminoids precipitated and those remaining in the juice. The gums, while largely removed, remain in greater quantity than in the neutral clarifications. In this clarification, 76 per cent of those present in the mill juice are removed, while 85.9 per cent and 82.9 per cent were removed by neutral clarification of juices of higher purity. Where conditions are the same a smaller percentage is removed from juices of higher purity.

From this it will be seen that as with lime alone, sulphurous acid in combination with lime gives the most effective clarification when juices are worked at neutrality. Further study of the action of sulphur and lime as clarifying agents was made; varying amounts of sulphur and lime were used, but each time bringing the juice near the neutral point.

In No. 1 and No. 2 the juice was sulphured with 2.45 cc. of sulphur dioxide, this amount being sufficient to bring the acidity to 3.75 cubic centimeters. Sufficient lime was then added to leave this juice with an acidity of 0.45 cc. Here we note very little improvement in the clarified juice over the mill juice. The purity of the clarified juice according to the Brix spindle is very slightly decreased, but the true percentage of solids shows an increased purity. The albuminoids are largely removed, while the amids and ash are unaffected, the removed mineral matters being substituted by the lime salts of sulphurous and sulphuric acids. The percentage of lime remaining in solution is considerably greater than that in the mill juice. The gums are slightly increased, though the extremely small quantity in this juice would so influence the quantity and percentage removed as to permit no comparison with the juices where the gums are present in average or larger quantities.

In No. 3 and No. 4 the mill and clarified juices are compared, using an increased amount of sulphur over No. 1 and No. 2

TABLE XXXI.

SULPHUR	Acidity	Alkalinity	Brix	Total Solids	Sucrose	Glucose	Solids Not Sugar	Coefficient of Purity	Glucose Ratio	Total Proteids	Albuminoids	Amids	Ash	Lime	Sulphurous Acid (S O2)	Sulphuric Acid (S O3)	Alcohol Precipitate	Albuminoids in Alcohol Precipitate	Ash in Alcohol Precipitate	Lime in Alcohol Precipitate	Gums etc.
1. Mill Juice....	1.30	....	15.33	15.31	12.00	1.59	1.74	78.28	13.25	.2383	.1426	.0960	.388	.025	....	....	.2230	.1104	.0950	.0135	.0176
2. Clarified Juice, sulphured to 3.75 cc. acidity and limed to 0 45 cc. acidity	0.45	....	15.40	15.01	12.00	1.61	1.79	77.92	13.42	.1371	.0387	.0984	.372	.080	0.94		.089	.017	.040	.0264	.0220
3. Mill Juice....	0.95	....	16.26	15.43	12.00	2.14	2.12	73.74	17.83	.2686	.1183	.1503	.423	.040	....	....	.5904	.1091	.1625	.0200	.2189
4. Clarified Juice, sulphured to 5.6 cc. acidity and limed and left slightly acid....	0.05	....	15.91	15.00	12.00	2.18	1.73	75.42	18.17	.1444	.0271	1173	.422	.060	....	....	.1955	.0097	.1200	.0378	.0685
5. Mill Juice....	0.95	....	15.62	15.25	12.00	1.69	1.93	76.82	14.08	.1718	.0973	.0845	.435	.038	....	....	.3897	.1482	.1129	.0165	.0586
6. Clarified Juice, limed and sulphured as in No. 4....	0.05	...	15.15	14.90	12.00	1.85	1.30	79.21	15.42	.1203	.0350	.0853	.344	.048	....	....	.2009	.0181	.1469	.436	.0359
7, Mill Juice....	1.90	....	16.20	15.81	12.00	1.94	2.26	74.07	16.17	.2067	.1286	.0781	.542	.035	....	....	.3033	.1072	.0706	.0085	.1255
8 Clarified Juice, limed to equivalent of 5.0 cc. alkalinity and sulphured till slightly acid....	0.40	....	16.19	15.51	12.00	1.99	2.20	74.12	16.58	.0948	.0171	.0777	.562	.077	.041	.108	.1663	.0079	.0909	.0385	.0677

and liming to very slight acidity, or, it may be said, practically to neutrality. The juice was sulphured to a total acidity of 5.6 cubic centimeters, and then limed to .05 cubic centimeter acidity.

The purity is increased 1.68 per cent over that of the mill juice, otherwise the sugar analysis is normal, the slight variation in glucose and glucose ratio being well within the limits of analytical error. Seventy-seven per cent of albuminoids present in the mill juice were removed, the ash was practically unchanged and 69 per cent of the gums were removed. Nos. 5 and 6 are a duplication as regards the residual acidity, sulphur and lime used, with the exception of liming first, heating till blanket broke, removing blanket and sulphuring till the juice was brought to an acidity of .05 cubic centimeter. Here an increase in purity of 2.39 is noted with a slight increase in glucose, due to sulphuring while the juice was hot, notwithstanding the fact that the juice was alkaline. When sulphurous acid gas entered the juice it neutralized the lime at the points of contact, causing a local acidity which at high temperatures exercised an inverting influence. There were removed 21 per cent of ash present, 63 per cent of albuminoids, and 39 per cent of gums. Comparing with sulphuring followed by lime, we find a slight increase in purity in favor of liming first, but the gums are removed in greater quantity and percentage by sulphuring first. It may be remarked that the amount of gums is much smaller in mill juice No. 5 than in No. 3. However, in No. 5 there is a considerable quantity and the difference in percentages removed is very great, 69 per cent in No. 3 and 39 per cent in No. 5 being eliminated. Continuing further with liming, using more lime as in clarified juice No. 6, there is no increase in purity by Brix, though the true solids show an increase. The glucose remains nearly the same, and no indication of inversion is seen. Here the ash is slightly increased. The sulphuring was to slight acidity and brought into solution some of the precipitated mineral matter, and in this respect this juice is very similar to clarified juice No. 2, both having the same acidity and nearly the same ratio between their ash contents and those of the mill juices. Of the albuminoids 86.7 per cent were removed, along with 46 per cent of the gums. This increase in the removal of the albuminoids is largely due to bringing the juice to acidity.

The amount of gums removed is small in comparison with the practically neutral clarification using sulphur first. Taking into consideration the difference in the amounts present in juices No. 5 and No. 7, the removal of gums is relatively close to the percentages removed by both clarifications where lime was added first.

From the two foregoing tables it is evident that the best sulphur-lime clarification is obtained by sulphuring strongly, then liming to neutrality.

COMPARISONS OF THE CLARIFIED PRODUCTS FROM COMBINATIONS OF LIME AND SULPHUR ON THE SAME JUICES.

In the following table these comparisons are brought out so as to eliminate the variations caused by cane juices differing in the amount and character of impurities present:

Examining Table XXXII, the first two results given are from the same mill juice sulphured to the same point (5 cubic centimeters). No. 1 was limed until the juice remained slightly acid, and No. 2 was limed until the juice was slightly alkaline. Both were then clarified by heating in the same manner. These results are rather peculiar, and unfortunately the amount of acidity and alkalinity in the clarifications was not determined; though from the results it was thought that No. 2 was left practically neutral. The purity of No. 1 is greater than No. 2; other variations in the sugar and solid content are not marked enough to comment on, taking the regular sugar analysis as a guide. However, in examining the impurities left, it will be noticed that more albuminoids, ash and gums remain in the acid than in the alkaline clarification. In the acid clarification the albuminoids are nearly four times the quantity of those in the alkaline clarification, the ash nearly one-fourth more, and the gums nearly double.

Nos. 4 and 5 are clarified juices from the same cane. No. 4 was limed to 1.5 cubic centimeters alkalinity and then clarified as in lime clarifications, and this clarified juice, without settling, was sulphured to 1.0 cubic centimeter acidity in No. 5, and again heated. Both clarifications show an increase in purity over the mill juice No. 3. The limed clarification showed an increase

TABLE XXXII.

	Number	Acidity	Alkalinity	Total Solids	Brix	Sucrose	Glucose	Solids Not Sugar	Coefficient of Purity	Glucose Ratio	Sulphurous Acid	Sulphuric Acid	Lime	Ash	Total Proteids	Albuminoids	Amids	Alcoholic Precipitate	Gums, etc., in Alcoholic Precipitate	Ash in Alcoholic Precipitate	Albuminoids in Alcoholic Precipitate	Lime in Alcoholic Precipitate
Sulphured to 5 cc. acidity. Lime added. leaving slightly acid	1	....	....	14.08	14.87	12.00	1.44	1.43	80.70	12.00	.1013	.....	.0502	.5620	.2820	.1020	.1800	.2580	.1610	.0360	.0610	.0005
Sulphured to 5 cc. acidity. Lime added to slight alkalinity	2	....	....	14.30	15.35	12.00	1.41	1.94	78.11	11.75	.0550	.....	.0670	.4150	.1890	.0280	.1610	.1060	.0880	.0160	.0020	.0080
Mill Juice..........	3	....	....	15.20	15.71	12.00	1.59	2.12	76.42	13.25	.....	.....	.....	....	.3620	.1150	.2470	.2670	.1260	.0420	.0990	.0060
Juice limed to 1.5 cc. alkalinity before sulphuring	4	...	1.50	15.10	15.57	12.00	1.47	2.10	77.07	12.25	.....	.....	.1940	.5090	.2580	.0430	.21 0	.3220	.2360	.0450	.0410	.0280
Clarified Juice sulphured to 1 cc. acidity	5	1.00	....	14.03	15.00	12.00	1.37	1.63	80.00	12.00	.0740	.0450	.1750	.4750	.2300	.0370	.1930	.2710	.2170	.0360	.0180	.0320
Juice limed to 3.3 cc. alkalinity before sulphuring	6	....	3.30	14.89	15.76	12.00	2.06	1.55	76.42	17.18	.....	....	.2760	.5780	.2330	.0300	.2030	.4010	.3350	.0320	.0340	.0240
Clarified Juice of No. 6 sulphured to 2.7 cc. acidity with settlings..	7	2.70	....	14.69	15.66	12.00	1.54	2.12	76.62	12.83	.2720	.0010	.2710	.7250	.2250	.0240	.2010	.2480	.1280	.1090	.0110	.0640
Clarified Juice of No. 6 sulphured to 2.7 cc. acidity after removal of settlings....	8	2.70	...	15.30	15.80	12.00	1.79	2.01	75.95	14.93	.1410	.0120	.2280	.5960	.2400	.0240	.2160	.2410	.1970	.0350	.0090	.0320

of 65 per cent and the limed and sulphured clarification, No. 5, an increase of 3.58 per cent over the mill juice, and 2.93 per cent over the limed clarification. The glucose was attacked by the excess of lime and .12 per cent converted into organic acids. In the sulphured and limed juice, .22 per cent glucose was attacked. This increase in the destruction of glucose is due to the longer time the excess of lime had to act, as this juice was allowed to cool before sulphuring. The glucose ratio of both clarifications is proportionately reduced. The amount of salts of sulphurous and sulphuric acids remaining in the lime and sulphur clarified juice, No. 5, are small and in proportion to their relative solubilities. The ash of No. 5 is reduced .025 per cent below No. 4, and the lime remaining in solution is .019 per cent, showing that the sulphur aided in removing some of these compounds. The albuminoids and gums are also less in the lime and sulphur clarification, and this is particularly favorable, since it has been noted that the glucose was attacked to a greater extent in this clarification than it was in the clarification with lime alone. The amids are also broken up in each clarification, more so in the lime and sulphur than in the lime clarification. This is also accounted for by the duration of the action of the excess of lime. From these results it will be noticed that on bringing an alkaline clarification back to acidity considerable improvement is made in the character of the juice, and the further action of the excess of lime is checked, which otherwise would continue active during evaporation. By increasing the alkalinity to 3.3 cubic centimeters, another study was made of the effect of sulphur in correcting this larger alkalinity, both in the juice with settlings remaining and in the settled juice. The sulphuring here was carried further (2.7 cubic centimeters acidity) in order to overcome the viscosity and to see its final effect on the gums. Nos. 6, 7 and 8 constitute this experiment. In No. 6 the juice contained 3.3 cubic centimeters excess of lime. In No. 7 the excess of lime was neutralized by sulphurous acid and the sulphuring was continued until the juice was 2.7 cubic centimeters acid. In this clarification the precipitate was allowed to remain suspended in the juice. No. 8 was treated as in No. 7, except the juice was settled and the precipitate removed before sulphuring. The purities vary, sulphuring increasing slightly the purity in the unsettled juice and showing a decrease in the purity of the settled juice. The glucose, while less than in the limed juice, shows a much greater destruction in the settled than in the unsettled juice. Sulphurous acid, both free and combined, is present in larger quantities than heretofore noted. This is to be expected from the acidity of the juice. The amount left in the settled juice is nearly one-half less than that left in the unsettled juices. The lime remaining in solution is practically the same in the limed and in the limed and sulphured juice unsettled, but a very appreciable increase is noted in the settled juice. These variations are due largely to the action of the sulphurous acid on the lime, both combined and mechanically held in the impurities. The ash of both settled and unsettled juices is more than that in the limed juice.

In the experimental runs as shown in Tables XXXIII and XXXIV the juice was sulphured to 5 cc. N-10 acidity and brought back with lime to 0.2 N-10 acidity per 10 cc. of juice. The evaporation and boiling were conducted in the usual way.

Practical exhaustion of the molasses in experiment I was obtained in two boilings. Contrary to what might be expected, a decided difference will be observed on comparing the record of this clarification with those of the alkaline class, especially as regards the increase in the purity of the clarified juice. Not the least evidence of inversion is noticeable; in fact, there is a perceptible falling off in the glucose ratio of the sulphured and clarified juices, due, perhaps, to a slight destruction of the reducing sugar during sulphuring and liming.

Inasmuch as the sulphitation process is the one most commonly practiced in Louisiana, a somewhat fuller account of the changes which take place in the clarification and boiling may be permitted.

The first action of the sulphur dioxide on entering the juice is to cause a coagulation of the albuminoid matter. A flocculent precipitate is formed which carries down not only the albuminoids of the juice, but mechanical impurities such as the fat and wax, particles of fibre and earthy matter from the cane, a considerable amount of gums, etc. The quantity of precipitate which will deposit after sulphuring amounts to from .3 to .4

TABLE XXXIII.

Sulphured to 5 cc. acidity.
Limed to 0.2 cc. acidity.

Striped and Purple Plant Cane.

	Total Solids	Sucrose	Dextrose	Levulose	Purity	Glucose Ratio	Ash	Free Acid	Combined Acid	Gums	Albuminoids	Amids
Raw Juice	13.24	9.62	1.14	1.04	72.66	22.66	0.38	0.10	0.12	0.09	0.102	0.163
Sulphured Juice	13.21	9.76	1.15	.95	73.88	21.51	0.38		0.12	0.07	0.019	0.193
Clarified Juice	13.11	9.89	1.12	.93	75.44	20.73	0.42	0.03	0.19	0.12	0.023	0.176
Syrup	50.00	36.15	4.45	4.11	72.30	23.68	1.66	0.14	0.84		0.119	0.663
First Masse cuite	90.00	69.54	8.57	8.07	77.28	23.92	3.08				0.165	1.200
First Sugar		95.80	2.66				0.72					
First Molasses	80.00	44.02	14.50	12.58	55.03	61.55	5.07		3.09	1.94	0.276	1.847
Second Masse cuite	90.00	48.25	16.38	13.81	53.60	62.58	5.78				0.287	2.248
Second Sugar		84.34	2.79	2.29			3.72					
Second Molasses	80.00	33.68	15.83	16.21	42.10	95.14	7.00				0.265	2.806

TABLE XXXIV.

Run 6. Sulphured to 5 cc. acidity.
Limed to 0.2 cc. acidity.

D. No. 74. Plant Cane.

	Total Solids	Sucrose	Dextrose	Levulose	Purity	Glucose Ratio	Ash	Free Acid	Combined Acid	Gums	Albuminoids	Amids
Raw Juice	14.97	11.97	0.73	0.84	80.00	13.11	0.47	0.13	0.18	0.09	0.097	0.116
Sulphured Juice	15 14	12.32	0.67	0.69	81.37	11.04	0.41		0.12	0.07	0.022	0.109
Clarified Juice	14.97	12.44	0.65	0.62	83.10	10.21	0.48	0.02	0.18	0.12	0.022	0.110
Syrup	50.00	41.02	2.14	2.22	82.04	10.62	1.73	0.08	0.84	0.62	0.177	0.288
First Masse cuite	90.00	76.13	4.04	3.78	84.59	10.26	2.98				0.159	0.696
First Sugar		94.10	2.08				0.91					
First Molasses	80.00	50.35	7.36	7.41	62.97	29.34	6.59				0.265	1.416
Second Masse cuite	90.00	56.85	8.01	9.24	63.18	30.35	6.97				0.294	1.800
Second Sugar		86.07	1.80	2.11			3.52					
Second Molasses	80.00	38.40	11.58	12.63	48.00	63.05	10.24				0.331	2.200

per cent of the weight of the juice. The composition of the air-dried sulphur precipitate for two seasons at the sugar-house of the Experiment Station is shown in the following table:

TABLE XXXV.

(Composition of Sulphur Precipitate.)

	Season of 1903.	Season of 1904.
Moisture	4.07%	4.49%
Fat and wax	32.57%	19.71%
Protein	23.63%	21.75%
Ash and earthy matter	9.48%	20.45%
Crude fibre	8.05%	10.37%
Gums, etc.	22.20%	23.23%
	100.00	100.00
Protein insoluble in pepsin (Nuclein bodies)	9.63	.....

The large amount of fat and wax contained in the precipitate is especially noteworthy; in fact, the dried deposits offer a most excellent material for the preparation of cane-wax. By boiling the finely ground precipitate with strong alcohol and filtering hot, the wax will crystallize out almost immediately. By filtering and recrystallizing several of them the wax of melting point 82° C. can be obtained perfectly pure.

If the sulphur precipitate could be removed before liming, the results accomplished by the subsequent clarification would be much more favorable. The removal of the deposits by filtration or sedimentation does not seem feasible, however, in commercial work. When lime is added and the juice heated a part of the suspended precipitate is redissolved. A portion of the gums pass again into solution; the nuclein compounds also appear to undergo a partial disintegration with the formation of xanthin and other nitrogenous bases, with the result that the percentage of nitrogen in the clarified juice usually exceeds that of the filtered sulphured juice. The lime uniting with the soluble sulphates and phosphates of the juice causes a considerable precipitation of these as insoluble salts of lime, which, with the undissolved matter of the sulphur precipitate constitute a greater part of the filter press cake. A large amount of the added lime, however, is retained in solution as soluble sulphite, so that the percentage of ash in the clarified juice may be even greater than before sulphuring.

The lime, which in the clarified juice and syrup exists in the form of soluble sulphite, undergoes a very rapid oxidation during the subsequent operations of the sugar-house, and in from four to eight weeks is largely changed to the form of sulphate. A large amount of insoluble sulphate of lime crystallizes out in the second masse cuite in the hot room, and being held back mechanically by the sugars in the centrifugals, causes a very marked increase in the ash content of the second sugars, as compared with the firsts. If the second sugars are dried very late a greater part of the insoluble lime sulphate may be removed at this stage, with the result that the second sugar contains a considerably higher percentage of ash than the thirds.

Other changes produced in cane products during the processes of manufacture will be referred to under the composition of cane molasses.

ACID CLARIFICATION WITH SULPHUROUS ACID, LIME, AND PHOSPHORIC ACID.

This method of clarification, which is practiced to a limited extent in Louisiana, consists in liming the sulphured juice to alkalinity and then bringing back to neutrality with phosphoric acid. The method gives usually a very fine clarification, but requires delicate manipulation at the latter stage of the process. If an excess of phosphoric acid is used the sulphite of lime is decomposed during the boiling, with the liberation of sulphur dioxide, which produces an inversion of sucrose.

In the following experiment the juice, after sulphuring to 5cc. N 10 acidity (10cc. juice), was limed to 1cc. alkalinity, and after heating and skimming was treated with phosphoric acid to 0.2cc. acidity:

TABLE XXXVI.

Sulphured to 5 cc. acidity.
Limed to 1 cc. alkalinity.
Phosphoric acid to 0.2 cc. acidity.

Second Year Stubble Cane. D. No. 74.

	Total Solids	Sucrose	Dextrose	Levulose	Purity	Glucose Ratio	Ash	Free Acid	Combined Acid	Gums	Albuminoids	Amids
Raw Juice	16.02	13.64	0.67	0.75	85.14	8.86	0.47	0.11	0.11	0.09	0.080	0.038
Clarified Juice	15.77	13.40	0.63	0.59	84.97	9.10	0.46	0.02	0.18	0.13	0.016	0.042
Syrup	50.00	39.97	2.65	2.62	79.93	13.21	1.81	0.09	0.82	0.47	0.118	0.118
First Masse cuite	90.00	73.76	4.81	4.62	81.95	12.26	3.29				0.185	0.206
First Sugar		92.30	2.34									
First Molasses	80.00	45.74	9.13	8.92	57.18	39.46	6.42				0.322	0.390
Second Masse cuite	90.00	51.44	10.46	10.93	57.16	41.78	7.18				0.332	0.425
Second Sugar		87.15	3.79									
Second Molasses	80.00	34.40	13.38	13.74	43.00	78.83	8.82				0.375	0.718

SUPERHEAT CLARIFICATIONS.

In these clarifications the results from the ordinary method of heating in an open vessel and that of heating under pressure (superheat) in a closed vessel are compared.

Table XXXVII shows the results with lime as the only clarifying agent:

The comparison of the action of lime alone in the ordinary and superheat clarifications, as shown in Table XXXVII, will be interesting.

In analyses No. 1 to No. 6, inclusive, the same degree of acidity is left after clarification and the clarified juices, 2, 3, 5 and 6, are comparable, 2 and 5 being clarified by ordinary method, and 3 and 6 by superheat. It will be noted that in both juices the effect of clarification was the same, the slight variations being about equally distributed and well within the limits of analytical error. In these clarifications the acidity of the juice was not all neutralized by lime, but .55 cubic centimeter acidity was allowed to remain, leaving us a fairly acid juice. Following this was an increase in the quantity of lime until the juice was very slightly alkaline (.1 cubic centimeter).

Comparing the superheat with the ordinary clarification, the same similarity in these results is noted as that occurring in the more acid juices, and again no appreciable difference is recorded. In examining Nos. 13, 14 and 15, where the liming has been carried on to alkalinity, the clarified juice being left .9 cubic centimeter alkaline, there is a considerable increase in the purity of the superheat clarification over both the mill juice and ordinary clarification. The superheat clarification showed 2.64 per cent increase in purity over the mill juice, and the ordinary clarification only .65 per cent increase. While this is quite a favorable increase and the other results are the same, or within very close limits, it must be noted that the glucose is attacked and there is a corresponding increase in gums. Both are slight, yet the gums in the clarified juices are higher than in the mill juice, and more than offset the increase in purity noted in the superheated clarification.

From these results no advantage or disadvantage can be placed to the superheat or the ordinary clarification from the action on the impurities, the results being practically identical except in alkaline juice, where the advantage is with the superheat clarification, though in this method the injury of the excess of lime would debar it from practice.

SUPERHEATED CLARIFICATIONS WITH LIME AND SULPHURED CANE JUICES.

These tests of the two methods of clarification were made as a continuation of the comparison of the superheat clarification with lime alone as a clarifying agent. Table XXXVIII shows the results:

In Table XXXVIII acid, neutral and alkaline clarifications are given, using nearly the same amount of sulphurous acid in each clarification.

The first comparisons of the clarifications were of a mill juice sulphured to 5.5 cubic centimeters acidity and lime added until the acidity was reduced to .5 cubic centimeter. Comparing the ordinary clarification with the mill juice, there is but slight variation in the solids or sugar content. Of the abuminoids, 74 per cent were removed and the gums show an increase of 21.9 per cent. The superheat clarification, No. 3, has a very slight increase in purity, not enough to justify any material benefit, but the decrease in glucose is, while slight, worthy of notice. The albuminoids remained the same and the gums increased over those present in the ordinary clarification, the increase being 31 per cent over those in the mill juice. In the neutral clarifications and the mill juices, Nos. 4, 5 and 6, the purity and glucose ratio are practically the same and nearly all of the albuminoids are removed in both clarifications. Of the gums 64.8 per cent are removed by ordinary clarification and 70 per cent in the super heat clarification, an advantage to superheating. The alkaline clarifications and mill juice from which they were obtained are given as Nos. 7, 8 and 9. Here increases of 1.11 per cent and 1.70 per cent in purity over that of the mill juice for the ordinary and superheat clarifications, respectively, are noted. The glucose is practically the same in the mill and both clarified juices.

The albuminoids are removed in the same quantity by both clarifications and gums in greater quantity by the ordinary clarifiction. Thirty-two and five-tenths per cent of those present in

TABLE XXXVII.

	Acidity of Juice	Alkalinity of Juice	Brix	Sucrose	Glucose	Solids Not Sugar	Purity Coefficient	Glucose Ratio	Total Proteids	Albuminoids	Amids	Alcoholic Precipitate	Gums, etc.	Ash in Alcoholic Precipitate	Albuminoids in Alcoholic Precipitate
1. Mill juice	1.55	......	14.61	12.00	1.14	1.47	82.13	9.50	.155	.083	.072	.181	.074	.046	.061
2. Ordinary clarification	.55	......	14.46	12.00	1.14	1.32	82.98	9.50	.104	.029	.075	.107	.048	.050	.009
3. Superheat clarification heated to 123° C.	.55	......	14.46	12.00	1.14	1.32	82.98	9.50	.104	.037	.067	.104	.053	.044	.007
4. Mill juice	1.60	....	15.24	12.00	1.78	1.46	78.74	14.83	.165	.065	.105	.148	.047	.049	.052
5. Ordinary clarification	.55	......	15.24	12.00	1.80	1.44	78.74	15.00	.078	.017	.061	.117	.057	.052	.008
6. Superheat clarification heated to 123° C.	.55	......	15.24	12.00	1.78	1.46	78.74	14.83	.075	.017	.058	.106	.156	.046	.004
7. Mill juice	1.80	......	14.85	12.00	1.46	1.39	80.80	12.17	.121	.069	.052	.212	.071	.073	.068
8. Ordinary clarification	....	0.10	14.61	12.00	1.45	1.15	82.13	12.09	.068	.013	.055	.099	.058	.029	.012
9. Superheat clarification heated to 123° C.	......	0.10	14.62	12.00	1.42	1.20	82.08	11.84	.068	.013	.055	.090	.052	.029	.009
10. Mill juice	1.85	......	15.00	12.00	1.38	1.62	80.00	11.50	.151	.089	.062	.194	.054	.076	.064
11. Ordinary clarification	.....	0.10	15.00	12.00	1.38	1.62	80.00	11.50	.101	.016	.085	.050	.024	.023	.003
12. Superheat clarification heated to 123° C.	.....	0.10	15.00	12.00	1.35	1.65	80.00	11.25	.089	.015	.074	.056	.022	.028	.006
13. Mill juice	2.1	......	15.00	12.00	1.50	1.50	80.00	12.50	.116	.071	.045	.1471	.066	.023	.058
14. Ordinary clarification	.....	0.90	14.88	12.00	1.32	1.56	80.65	11.00	.061	.010	.051	.128	.074	.019	.035
15. Superheat clarification heated to 123° C.	......	0.90	14.52	12.00	1.33	1.19	82.64	11.09	.067	.013	.054	.134	.071	.022	.041

TABLE XXXVIII.

	Acidity	Alkalinity	Brix	Sucrose	Glucose	Solids Not Sugar	Purity Coefficient	Glucose Ratio	Gums and Acids	Total Proteids	Albuminoids	Amids	Alcoholic Precipitate	Gums, etc., in Alcoholic Precipitate	Ash in Alcoholic Precipitate	Albuminoids in Alcoholic Precipitate
1. Mill juice	2.40	....	15.85	12.00	2.40	1.45	75.71	20.00	....	.111	.062	.049	.212	.128	.050	.034
2. Ordinary clarification sulphured to 5.5cc acidity and limed to .5 cc. acidity	0.50	.....	15.83	12.00	2.43	1.40	75.81	20.25	.....	.062	.016	.046	.245	.156	.071	.018
3. Sulphured clarification of No. 2 heated to 130° C.	0.50	......	15.79	12.00	2.33	1.46	76.00	19.42	...	.059	.016	.043	.276	.169	.090	.017
4. Mill juice	1.55	......	14.32	12.00	1.51	0.81	83.79	12.58	.....	.104	.052	.052	.176	.053	.060	.053
5. Ordinary clarification sulphured to 6 cc. acidity and limed to 0.1 cc. alkalinity	......	0.10	14.31	12.00	1.53	0.78	83.86	12.75	......	.048	.007	.041	.062	.043	.016	.003
6. Superheat clarification of No. 5	......	0.10	14.23	12.00	1.50	0.73	84.33	12.50	......	.045	.003	.042	.052	.042	.010	.0005
7. Mill juice	2.20	......	14.85	12.00	1.69	1.16	80.81	14.08	....	.133	.063	.070	.234	.111	.082	.041
8. Ordinary clarification sulphured to 5.2cc acidity and limed to 1.0 cc. alkalinity	.....	1.00	14.65	12.00	1.68	0.97	81.92	14.00	.....	.078	.013	.065	.158	.057	.090	.011
9. Superheat clarification of No. 8 heated to 130° C.	......	1.00	14.54	12.00	1.65	0.89	82.51	13.75	.....	.080	.014	.066	.179	.079	.087	.013

the mill juice are removed by ordinary clarification, while 23.5 per cent are removed by the superheat clarification.

Here the ordinary clarification gives better results than the superheat.

In comparing the above we find the greatest variation in the amount of gums left in the clarified juices, the ordinary method of clarification giving better results in acid and alkaline clarifications and the superheat having the advantage in neutral clarification. None of these advantages are great, and it may be said that with sulphur and lime used in clarifying there is very little difference between the superheat and the ordinary clarifications on mill juice.

Reviewing the action of sulphur and lime on clarified juices, we note that the greatest efficiency was obtained when sulphur was used in large quantities and then neutralized with lime, sulphuring to 10 cubic centimeters acidity and liming to neutrality giving the best clarification and removing a considerably greater percentage of gums than any other combination of lime and sulphur. The use of lime followed by sulphur shows in no instance any advantage over sulphuring first, and in some clarifications a distinct disadvantage.

Neutral clarifications give the best results, leaving less impurities of all characters than acid or alkaline clarifications. Albuminoids are largely removed by all clarifications, but the largest percentage is removed by the neutral. Amids are not removed by any process, but are increased by alkaline clarifications, though in some instances they are decomposed with a liberation of ammonia and formation of organic acids.

PHOSPHORIC ACID AND LIME CLARIFICATIONS.

Phosphoric acid is used in clarification to remove the excess of lime added to the juice. It unites with lime, forming phosphate of lime, which is practically insoluble in the juice.

The following table gives the superheat clarification, using phosphoric acid and lime as clarifying agents:

TABLE XXXIX.

	Acidity	Alkalinity	Brix	Sucrose	Glucose	Solids Not Sugar	Purity Coefficient	Glucose Ratio	Total Proteids	Albuminoids	Amids	Alcoholic Precipitate
1. Mill juice	1.50	.....	15.15	12.00	.....	.....	79.21	......	.103	.052	0.51	.173
2. Ordinary clarification limed to 1.5 cc. alkalinity and Phosphoric Acid added to 0.1 cc. acidity	0.10	...	15.00	12.00	....	......	80.00	. .....	.079	.013	0.66	.014
3. Superheat clarification of No. 2 heated to 130° C	0.10	.....	14.75	12.00	.....	......	81.35	......	.065	.013	.052	.029
4. Mill juice	1.75	.....	14.29	12.00	1.40	0.89	83.98	11.67	.092	.050	.042	.148
5. Ordinary clarification limed to 2 cc. alkalinity and Phosphoric Acid added to 0.5 cc. acidity	0.50	.....	13.97	12.00	1.40	0.57	85.89	11.67	.053	.009	.044	.067
6. Superheat clarification of No. 5	.050	......	14.02	12.00	1.45	0.57	85.59	12.08	.048	.006	.042	.079

On comparing the results in the above table, it is first to be regretted that, owing to an accident in the laboratory, they are only partially complete. However, there are enough data to judge the merits of the clarification.

Having seen the disadvantages of heavy liming, followed by either sulphurous or phosphoric acid, and having noted the danger from leaving juices alkaline, it was thought best to make these clarifications slightly acid, or, in the cases of Nos. 1, 2 and 3, nearly neutral.

The first clarifications, Nos. 2 and 3, were limed to 1.5 cubic centimeters alkalinity, then, without settling, phosphoric acid was added to slight alkalinity (.1 cubic centimeter). Here an increase in purity over the mill juice is noted both by the superheat and ordinary clarifications, the ordinary causing an increase of .76 per cent and the superheat 1.14 per cent. The albuminoids removed are the same, 75 per cent of those present in the mill juice in each clarification. The gums were not estimated, but the alcohol precipitate which contains them shows only a very small quantity remaining in the ordinary clarification, while in the superheat clarification the alcohol precipitate is double the quantity of the ordinary, and a proportionate increase in gums in this clarification over the ordinary clarification is indicated.

Continuing further these clarifications, increasing the quantity of lime to 2 cubic centimeters alkalinity and adding phosphoric acid to .5 cubic centimeter acidity, there is noted an increase in purity in both ordinary and superheat clarifications, the ordinary clarification showing the greater increase. The glucose is not changed in the ordinary clarification and shows a slight increase in the superheat clarification. The albuminoids are largely removed by both procedures, 82 per cent being removed by ordinary clarification and 88 per cent by superheat. The gums, etc., were not directly determined. The alcohol precipitate shows evidences of their removal in considerable quantity, though, as was to be expected, a less amount was removed by the strongly acid clarification than by the nearly neutral ones. The superheat here again gave evidence that more gums remain in the clarified juice here than in the ordinary clarification.

The increase in glucose ratio and decrease in purity between the raw juice and syrup show that a very noticeable inversion took place in the early stages of the process.

We have already called attention to the fact that the use of phosphoric acid in clarification occasionally gives trouble by rendering the molasses turbid through formation of insoluble lime phosphate. This is also the case when a dilute solution of phosphoric acid is used for washing sugars in the centrifugals (a questionable practice at the best) and the washings are allowed to flow into the molasses. A number of cases have been reported where open kettle molasses depreciated in market value as a result of the turbidity resulting from this cause.

As a general summary of the foregoing experiments upon alkaline and acid clarifications, we may say that for Louisiana conditions, where the juices usually contain a high percentage of reducing sugars as compared with tropical countries, a carefully conducted sulphitation gives the most satisfactory results from the point of economy, as well as from the favorable outturn of sugar. It is needless to add that in this, as in all other methods of clarification, satisfactory results can be secured only when the process is subjected to a most rigid chemical control.

OTHER EXPERIMENTS IN CLARIFICATION.

From time to time notices appear of startling results obtained by some new process of clarification. The announcement, however, is usually soon forgotten, the experiment joining the silent majority of those pronounced non-feasible. In one of the foreign sugar journals some years ago appeared a list of nearly three hundred chemicals which had been tried or proposed for clarifying saccharine juices, but it is doubtful if the following method, which the Sugar Experiment Station was requested to investigate some time ago, is in this catalog.

The inventor proposed to make use of the rare mineral, *monazite,* which occurs in Brazil, and also to some extent in North Carolina. This mineral, which consists of a beautiful gold-colored sand, contains a number of rare metals, the oxides of which are largely used at present in the preparation of the well-known Welsbach mantles for gas burners. The clarifying agent in this new method consists of the gelatinous hydrates of these same rare earths. Very extravagant claims were made for this process. We quote as follows: "The gelatinous oxides of monazite prevent inversion and alcoholic fermentations, precipitate pigments and albuminoid matter, and consequently clarify and bleach the juice." The inventor then states: "At first one might suppose that this process would not be practical commercially on account of the cost of the clarifying agent, but it is not so, for the gelatinous oxides of the monazite are recovered after the clarification, calcined to destroy organic impurities, then dissolved in nitric acid and reprecipitated by ammonia for further use." The complications of recovery would alone impede the introduction of this process, but aside from this, experiments showed that the hydrates from monazite possessed no advantages in clarifying beyond that of any other gelatinous oxide. Hydrated alumina was found to answer equally well, if not better, and alumina has long been discarded as a clarifying agent in the sugar-house.

Another method of clarification, which the Experiment Station examined, seemed to possess, at first sight, greater possibilities of commercial success than the one just described. This was the electrical process, of which we hear so much from time to time. In this process a strong electric current was passed through the juice between electrodes composed of an alloy of aluminum and magnesium. Considerable heat was developed, the juice was bleached, and a flocculent precipitate thrown down. An analysis of the juice before and after clarification gave the following results:

	Before. Clarification.	After Clarification.
Brix	15.55	15.39
Sucrose	12.20	12.30
Glucose	1.98	1.79
Ash	0.31	0.35
Freed acid cc. N-10 alkali to 100gms	10cc.	4cc.
Coefficient of purity	78.1	79.9

The analysis shows no inversion of sucrose and a decided gain in purity. The acidity is reduced over one-half, but the marked increase in ash shows that this is largely the result of the action of the acids of the juice upon the electrodes. The clarifying effects of the process seem to be due partly to the influence of the heat developed, partly to the action of the dissolved alumina, and partly to the action of the gases generated during the electrolysis.

The great expense connected with this method of clarification will prevent its general introduction. The installation and renewal of electrodes is very costly and such an outlay of electrical energy is required to accomplish satisfactory results that the undertaking cannot be made profitable.

VII. SCHEMATIC TABULATION OF YIELDS AND COMPOSITIONS OF SUGAR-HOUSE PRODUCTS.

As a general summary of the experiments previously described, the yields and compositions of the different products obtained from various qualities of cane juice have been condensed into tabular form. The tables which are given below do not represent any particular experiment, but are made up from the average results of many years' work in the sugar-house and laboratory. The figures showing the yield of products are obtainable only under the best of sugar-house conditions when there are no losses from inversion or entrainment.

At the beginning of the sugar season in Louisiana the juices are of relatively low sucrose content and of inferior purity, and two boilings are usually sufficient to obtain all the available sugar. Table XL gives the yields and compositions of the various products obtained with a low grade juice of this description. Table XLI gives the results obtained later in the season with an average juice, and Table XLII the yields and compositions of products from a high grade juice toward the close of grinding.

All calculations were performed upon the basis of 1,000,000 pounds of cane and an extraction of 75 per cent. The compositions of syrups, molasses and masse cuites were all made upon a percentage of total solids of 50, 80 and 90, respectively, these figures being the general average, though individual instances may show considerable variation from these percentages.

TABLE XL.

(Yields and Compositions of Sugar House Products from a Poor Juice.)

	Pounds	Total Solids	Sucrose	Dextrose	Levulose	Ash	Albuminoids	Amids, etc.	Acids, Gums, etc.
Cane	1,000,000								
Raw Juice	750,000	13.50	10.00	1.20	0.80	0.45	0.10	0.15	0.80
Sulphured Juice	750,000	13.30	10.00	1.20	0.80	0.40	0.02	0.15	0.73
Clarified Juice	750,000	13.20	10.00	1.20	0.80	0.45	0.03	0.15	0.57
Syrup	198,000	50.00	37.90	4.40	3.20	1.70	0.10	0.58	2.12
First Masse cuite	110,000	90.00	68.20	7.00	6.60	3.00	0.15	1.05	4.00
First Sugar	48,000	98.75	96.00	0.80	0.70	0.80	0.01	0.04	0.40
First Molasses	64,500	80.00	44.80	11.40	10.80	4.50	0.22	1.78	6.50
Second Masse cuite	57,330	90.00	50.40	12.50	12.50	5.00	0.23	1.97	7.40
Second Sugar	20,000	94.00	80.00	3.90	4.10	3.00	0.06	0.64	2.30
Second Molasses	41,000	80.00	31.40	15.00	16.00	5.60	0.30	2.40	9.30

TABLE XLI.

(Yields and Compositions of Sugar House Products from an Average Juice.)

	Pounds	Total Solids	Sucrose	Dextrose	Levulose	Ash	Albuminoids	Amids, etc.	Acids, Gums, etc.
Cane	1,000,000								
Raw Juice	750,000	15.00	12.00	1.00	0.70	0.45	0.10	0.10	0.65
Sulphured Juice	750,000	14.80	12.00	1.00	0.70	0.40	0.02	0.10	0.58
Clarified Juice	750,000	14.70	12.00	1.00	0.70	0.45	0.03	0.10	0.42
Syrup	220,588	50.00	40.80	3.20	2.58	1.50	0.09	0.33	1.50
First Masse cuite	122,550	90.00	73.44	5.70	4.70	2.70	0.13	0.63	2.70
First Sugar	54,000	98.75	96.00	0.80	0.70	0.80	0.01	0.05	0.39
First Molasses	71,213	80.00	53.60	8.76	8.00	4.00	0.20	0.94	4.50
Second Masse cuite	63,300	90.00	60.30	9.43	9.43	4.50	0.21	1.08	5.05
Second Sugar	24,000	95.50	85.00	2.90	3.10	2.50	0.06	0.34	1.60
Second Molasses	42,563	80.00	41.70	12.20	12.50	5.35	0.25	1.50	6.50
Third Masse cuite	37,833	90.00	46.90	13.30	14.50	6.00	0.26	1.70	7.34
Third Sugar	10,000	94.00	80.00	3.80	4.20	3.50	0.07	0.43	2.00
Third Molasses	30,750	80.00	31.70	15.00	16.50	6.30	0.38	2.00	8.20

TABLE XLII.

(Yields and Compositions of Sugar House Products from a Good Juice.)

	Pounds	Total Solids	Sucrose	Dextrose	Levulose	Ash	Albuminoids	Amids, etc.	Acids, Gums, etc.
Cane	1,000,000								
Raw Juice	750,000	15.50	13.50	0.60	0.40	0.40	0.10	0.15	0.35
Sulphured Juice	750,000	15.35	13.50	0.60	0.40	0.38	0.02	0.15	0.30
Clarified Juice	750,000	15.30	13.50	0.60	0.40	0.42	0.03	0.15	0.20
Syrup	229,500	50.00	44.10	1.80	1.50	1.37	0.08	0.51	0.64
First Masse cuite	127,500	90.00	79.40	3.10	2.80	2.50	0.12	0.88	1.20
First Sugar	72,000	98.75	96.00	0.80	0.70	0.80	0.02	0.13	0.30
First Molasses	54,563	80.00	58.90	6.00	5.80	4.70	0.25	1.85	2.50
Second Masse cuite	48,500	90.00	66.20	6.65	6.65	5.30	0.26	2.10	2.84
Second Sugar	25,000	96.50	90.00	1.40	1.60	2.50	0.05	0.40	0.55
Second Molasses	24,269	80.00	39.70	11.40	12.00	8.00	0.40	3.50	5.00
Third Masse cuite	21,572	90.00	44.60	12.30	14.00	9.00	0.41	3.69	6.00
Third Sugar	5,000	95.75	85.00	2.80	3.20	3.50	0.06	0.49	0.70
Third Molasses	18,284	80.00	29.40	13.60	15.80	9.80	0.43	3.97	7.00

The results shown in Table XL (two boiling) with a poor juice of low purity indicate a yield of 136 pounds (6.8%) commercial sugars, or 124 pounds (6.2%) pure sucrose and 82 pounds residual molasses (about 7 U. S. gallons) per ton of cane.

Table XLI (three boilings) with an average juice of 80 purity shows a yield of 176 pounds (8.8%) commercial sugars, or 160 pounds (8%) pure sucrose and 61.5 pounds residual molasses (about 5 U. S. gallons) per ton of cane.

Table XLII (three boilings) with a superior juice of nearly 90 purity, shows a yield of 204 pounds (10.2%) commercial sugars, or 192 pounds (9.6%) pure sucrose and 36.5 pounds residual molasses (about 3 U. S. gallons) per ton of cane.

VIII. THE COMPOSITION OF LOUISIANA MOLASSES.

The composition of the first, second and third molasses has been given in many of the preceding tables. A somewhat closer examination of several constituents will be of value, particularly as regards ash and nitrogenous bodies.

The composition of the ash of residual molasses from several sugar-houses in Louisiana is given in Table XLIII.

TABLE XLIII.

(Composition of Ash from Different Molasses.)

		I	II	III	IV
		Mill Sulphitation	Diffusion Sulphitation	Open Kettle	Carbonatation
Potash	K_2O	49.48%	52.20%	51.48%	50.16%
Soda	Na_2O	0.89	0.80	1.11	0.32
Lime	CaO	6.47	6.78	6.58	8.53
Magnesia	MgO	4.29	3.09	3.99	2.66
Iron Oxide	Fe_2O_3	0.35	0.33	0.15	0.47
Alumina	Al_2O_3	0.30	0.22	0.13	0.30
Silica	SiO_2	4.12	4.59	2.83	4.10
Phosphoric Acid	P_2O_5	3.71	3.80	2.12	0.91
Sulphuric Acid	SO_3	10.79	6.72	10.94	11.18
Carbonic Acid	CO_2	7.49	11.19	13.06	15.78
Chlorine	Cl	14.00	11.95	9.10	4.59
Total		101.89	101.67	101.49	99.00
Deduct O = Cl		3.16	2.70	2.05	1.04
		98.73	98.97	99.44	97.96
Undetermined (Carbon, etc.)		1.27	1.03	0.56	2.04
Alkalinity (cc. $\frac{N}{10}$ per gr. ash)		80cc	93cc	95cc	109cc

Comparison of the above analyses with those of the ash of cane juices (Table XXII) shows several very striking differences. There is only about one-half the quantity of sulphuric acid in the molasses ash, notwithstanding the heavy sulphuring which some of the juices received. This, of course, is due to the removal of the sulphuric acid as calcium sulphate; the same holds true of phosphoric acid. We note also an increase in the amount of lime in the molasses ash, with a corresponding increase in carbonic acid and alkalinity and a decrease in iron, alumina and silica. The variations in chlorine content of the four ashes are especially noteworthy, and we have here a good illustration of the influence of local conditions upon the composition of cane products. Molasses I was produced upon a plantation near the Gulf, where the cane fields are occasionally flooded with salt water; molasses IV, on the other hand, was produced on a plantation in the interior of Louisiana, over a hundred miles from the coast. The excess of chlorides in Lower Coast molasses such as I is frequently perceptible to the taste, and this, of course, affects its sale for household purposes.

The distribution of the nitrogen of residual cane molasses among the different bodies shows, as might be supposed, very noticeable differences from what exists in the raw juice.

TABLE XLIV.

(Distribution of nitrogen in sugar cane molasses.)

	Percentage in Molasses.	Percentage of Total Nitrogen.
Nitrogen in albumoses and peptones	0.0153%	3.28%
Nitrogen in amido-acids	0.1774%	38.00%
Nitrogen in amido-acid amids	0.0672%	14.38%
Nitrogen in ammonia	0.0147%	3.15%
Nitrogen in nitrates	0.0370	7.92
Nitrogen in nitrogenous bases (xanthin, etc.)	0.1113%	23.83%
Nitrogen in other forms	0.0441%	9.44%
Total	0.4670	100.00

A comparison of Tables XLIV and XIII shows very marked differences. The large amount of nitrogen in the molasses in the form of xanthin bodies is especially noticeable, those constituents being almost completely absent in the juice. The xanthin and other nitrogenous bases in the molasses are no doubt largely formed by a breaking up of the nucleo-proteids during clarification and by the disintegration of the soluble albumoses during the whole process of manufacture.

Among other ingredients which accumulate in the final molasses in large amounts are the organic acids (principally as lime and potash salts) and the gums. These are derived partly as such from the original juice and partly from the decomposition of the sugars, amids and other organic ingredients during manufacture. Investigations of these constituents are at present being carried out, and we hope in the near future to give a fuller account of their nature and characteristics.

REWORKING OF MOLASSES WITH FIRST PRODUCTS.

In the foregoing descriptions of sugar-house operations, the sugars were obtained from the juice in two or three different operations. A few plantations in Louisiana have made a practice of obtaining all their sugars in one operation without the use of a hot room. In this process the molasses from the centrifugals is either run back into the mill juice before sulphuring and reworked or is taken up into the pan and reboiled after grain has been formed from a fresh lot of syrup. This process is kept up for three or four rounds when the accumulation of impurities becomes so great that its further continuation is undesirable. The molasses is then withdrawn from circulation either wholly or in part, and the process continued as before.

While the above process or some of its numerous modifications may effect a considerable economy of time and space in the sugar-house, it is never possible to obtain the exhaustion attainable by the old hot room method. The following series of analyses by Chiquelin of molasses obtained from four consecutive strikes by a process of the above description and of the final molasses as withdrawn from circulation, will be of interest:

TABLE XLV.

	No.	Total Solids	Sucrose	Glucose	Solids Not Sugar	Purity	Glucose Ratio
First Strike	1	78.09	52.00	14.70	11.39	66.58	28.27
	2	80.00	48.50	16.50	14.99	60.64	34.01
	3	77.77	47.45	16.02	14.30	61.06	33.76
	4	78.25	47.99	15.15	15.11	61.32	31.57
	Average..	78.53	48.99	15.59	13.95	61.90	31.90
Second Strike	5	74.86	45.73	18.87	10.20	61.07	41.26
	6	72.54	40.87	14.70	15.97	57.12	33.52
	7	74.64	46.03	15.38	13.23	61.67	33.41
	8	71.22	39.52	14.28	17.42	55.49	36.13
	Average..	73.06	43.04	15.81	14.21	58.84	38.58
Third Strike	9	81.16	43.05	17.58	20.53	53.04	40.83
	10	80.77	42.60	16.66	21.51	52.74	39.10
	11	79.00	42.08	16.66	20.26	53.26	39.58
	12	79.02	42.26	16.13	20.63	53.48	38.16
	Average..	79.99	42.50	16.76	20.73	53.13	39.42
Fourth Strike	13	80.55	40.65	14.81	25.09	50.34	36.43
	14	83.71	43.55	16.66	23.50	52.02	38.25
	15	80.57	39.47	14.81	26.29	48.98	37.52
	16	81.24	39.80	14.81	26.63	48.99	37.21
	Average..	81.52	40.87	15.27	25.38	50.08	37.35
Final Molasses...		80.87	39.76	18.34	22.77	49.16	46.12

The results show a continued accumulation of impurities in the molasses after each round, especially at the third and fourth strikes. The mixing of the molasses, juices and syrups of ever-varying composition and purity of course complicates the control of such a method of manufacture. The final molasses by the above process when withdrawn has a sucrose content and purity of ordinary hot room second molases, but the presence of excessive amounts of gummy decomposition products rendered further working of the residue inadvisable.

IX. EFFECTS OF FERMENTATION UPON THE COMPOSITION OF SUGAR CANE PRODUCTS.

Before concluding this bulletin upon the composition of the sugar cane and its products, a brief account of some of the abnormal constituents, which are sometimes formed by the activity of yeasts, moulds and bacteria, will be of value.

The number of micro-organisms which produce decomposition of cane products is almost unlimited, and the chemical changes which develop, especially when several fermentations take place simultaneously, are necessarily very complex. In the brief space at our command we can only take up a few of the typical and more common fermentations.

The most common fermentation which the raw juice of the cane undergoes in Louisiana is not the alcoholic, as might be supposed, but a fermentation designated variously as the viscous. mucilaginous or mannitic. This fermentation is anaerobic in character; a most powerful reducing action in consequence takes place, by virtue of which the juice is rapidly bleached. The liquid becomes thick and ropy, and if the culture be pure the juice will finally set to a perfectly solid jelly. Various organisms may produce this type of fermentation, but the best known member of this class of bacteria is the *Leuconostoc* or *Streptococcus mesenteroides,* the so-called "frog spawn" of the beet sugar manufacturer. This fermentation was one of the first to attract the attention of investigators and the study of its products of decomposition constitutes an interesting chapter in the subject of biochemistry.

Vanquelin in 1822 caused four bottles of cane juice to be sent from Martinique to France. The samples arrived, however, in a very bad condition, the juice having changed to a thick mucilage. Vanquelin therefore busied himself with a study of the gummy matter into which the sugar had been changed, but the methods of organic analysis at that time were in their infancy, and no definite knowledge of the gum seems to have been gained. Peligot, Kircher, Brüning and many others also occupied themselves with the problem, studying the gummy fermentation products of both cane and beet juices. Durin[*] regarded the constituent of this gum as cellulose and felt so certain of his ground that he took out a patent—a curiosity of its kind—for the "conversion of crystalline sugar into cellulose and for any use which such cellulose can find technically." It was Scheibler who first established the real nature of the product; he proved the gum to be a body very similar to dextrin and named it dextran. Scheibler himself, however, fell into an error, for he regarded the gum not as a fermentation product, but as a substance occurring naturally in the plasms of the beet-cells.

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[*] "De la fermentation celluloisque du sucre de canne". Comptes Rendus. 83,128. 1876.

[†] Zeits. des verein d. deutschen Zucker-Industrie. 1869. p. 472:1874. p. 309:1875 p. 112.

Dextran was prepared from samples of clarified cane-juice, which had undergone the viscous fermentation, by precipitating with 95% alcohol. The gum was filtered off and repeatedly purified by dissolving in dilute sodium hydrate, filtering and precipitating with alcohol acidified with hydrochloric acid. After washing with alcohol and ether, the gum was dried first at 60° and then, after pulverizing, at 100°, and finally at 130°. The product thus obtained was perfectly white and contained 1.65% of ash, mostly Na Cl. The following analysis, calculated to ash free substance, was obtained:

		Theoretical for	
	Found.	$(C_6H_{10}O_5)n$—	$3(C_6H_{10}O_5), H_2O$.
Hydrogen	6.54%	6.22	6.40
Carbon	42.50	44.42	42.83

Other analysts have reported for dextran 41.45-43.61% carbon. The formula usually assigned to dextran is $(C_6H_{10}O_5)n$, the same as that of cellulose. The writer, however, is inclined to the belief that dextran is a hydrated product of variable composition.

A sample of dextran weighing .3848 grm. was dissolved to 50 cc., a drop of ammonia being added to secure freedom from opalescence. The solution gave a polariscopic reading of +4.47 Ventzke in the 100 mm. tube, from which the specific rotation $\left[\alpha\right]^{20°}_{D} = \frac{.3468\times4.47\times50}{.3848} = +201.8$. The results recorded in the literature for the specific rotation of dextran vary from +195 to +230.

The presence of dextran in sugar-cane products may introduce an error into the analytical work. It happens occasionally in Louisiana that the sugar cane is damaged by a splitting freeze; on the occurrence of warm weather a fermentation sets in, with the formation of considerable dextran within the cane. In analyzing juices from such canes the inexperienced chemist is often puzzled because his juices polarize well, yet give him poor returns in the sugar-house. The following analyses of badly fermented cane-juices will show the influence of dextran upon the polarization:

TABLE XLVI.

No.	Degrees Brix.	Polarization.	Sucrose.	Reducing Sugars.	Dextran.	Apparent Purity.
1...	7.8	+18.0	0.0%	0.15%	5.90%	232
2...	4.8	+10.4	0.0	trace	3.35	216

The occurrence of dextran in cane syrups and molasses might lead the food chemist to suspect an adulteration of these products with commercial glucose, when in reality no such adulterant was present.

The viscous fermentation, as was stated, exerts a powerful reducing action upon the cane juice, and as a consequence of this reduction various deoxidation products are formed. The most common of these is mannite, which was very early recognized among the products of this fermentation, and for this reason the name mannitic fermentation was sometimes applied. It was at first supposed that the mannite was the product of a special organism, but this is a mistake, for mannite may be formed in any fermentation of sugar where a reducing action takes place. The quantity of mannite in fermented juices will vary; juices which showed over 2% mannite were found on subsequent analysis to be nearly deficient in the same, owing to the fact that other fermentations had set in, whereby the mannite was destroyed.

Among the products of the different anaerobic fermentations to which cane juice is subject are various gaseous bodies. In cane juices clarified by the sulphitation process, especially such as have been afterwards treated with phosphoric acid, fermentation occasionally sets in and large quantities of hydrogen sulphide are evolved. The odor of this gas is usually very noticeable around fermenting press cakes. In other cases hydrogen is given off and serious accidents have been reported through the explosion of this gas, generated from juice or syrup that had been left standing in vacuum pans or effects. When fermentation of the juice and bagasse together takes place, as may occur in a diffusion battery, the cellulose of the cane fibre undergoes a decomposition, and the gas given off contains methane as well as hydrogen. Explosions of diffusion cells in sugar beet factories from this cause have been reported not in-frequently. The fermentation which takes place in bagasse piles is usually of the butyric order, as may be recognized by the peculiar rancid odor which is given off.

Reference was just made to Durin's patent for obtaining cellulose from sugar. Notwithstanding the fact that Scheibler proved Durin's cellulose to be an entirely different body, cellulose may be formed from sugar in large amounts by the activity of bacteria. A fermentation of this kind was reported in the Louisiana Sugar Planter (Vol. 34, p. 238) by the writer several years ago, and more recent investigations show that this fermentation is one of very general occurrence in Louisiana.

This fermentation, unlike the viscous, is aerobic. Large gelatinous lumps of leather-like toughness are formed in the juice. These lumps, which sometimes weigh several pounds, are stratified in appearance and are, as a matter of fact, made up of an infinite number of closely compacted membranes. The substance of these membranes on boiling with alkali does not pass into solution, as is the case with dextran, but shrivels up into a dense white body, which gives all the reactions of cellulose, yielding a blue coloration with zinc chloride and iodine and being 99 per cent soluble in cupro-ammonium. The percentage composition of the purified substance precipitated from cupro-ammonium agreed with that for cellulose.

	Found.	Theoretical for $(C_6H_{10}O_5)n$
Hydrogen	6.28 per cent.	6.22 per cent.
Carbon	43.87 per cent.	44.42 per cent.

The amount of dried membrane formed by this fermentation in a cane juice was about 13% and the amount of cellulose about 7% of the total sugar fermented. When examined under the microscope the membranous tissue is seen to consist of interwoven chains of bacteria imbedded in the capsular matter, which constitutes the real substance of the membrane. Intermingled with these bacterial chains a great many yeast cells are usually visible, and it may be that we have here a case of symbiosis, such as occurs with the ginger beer ferment, which was formerly employed quite extensively in the Southern States for making molasses beer.

As constituents of the deposits and scums which always form in fermenting juices, syrups and molasses, we have a number of substances which, like dextran and cellulose, are to be regarded as of assimilative rather than of fermentative origin. Such, for example, is mannan; the mixed sediment of yeast cells, mycelia, etc., found in decomposed juices and syrups, always contains this body.

Another common ingredient of these fermentation products is the nitrogenous body chitine. We have found this substance to be a very important constituent of the scums* which form every year upon the surface of molasses left over in the hot room. These scums, upon washing out the adherent molasses, constitute a brownish-colored pulpy mass, a sample of which air-dried gave the following analysis:

Moisture	10.00%
Chitine	11.30%
Protein	31.62%
Fat	27.50%
Ash	5.58%
Undetermined (N. free)	14.00%

After extracting the dried material with successive portions of ether, boiling soda, hot water and alcohol, about 15% of insoluble residue was obtained, which analysis showed to be 90% chitine. This residue on boiling with concentrated hydrochloric acid gave a dark-colored solution, which on evaporation yielded beautiful glistening crystals of glucosamine hydro-chloride, $C_6H_{11}(NH_2)O_5HCl$. These crystals were easily soluble in water and gave in the polariscope a specific rotation of +70.45, a little higher than that of sucrose.

The large amount of fat in the molasses scums (27.50%) is noteworthy, and what is more remarkable, the composition of this fat, as is shown from its physical and chemical constants, agrees very closely with that of butter fat.

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*These scums are produced by a fungus which has since been identified by Mrs. F. W. Patterson of the Bureau of Plant Industry, U. S. Department of Agriculture, as belonging to the genus citromyces.

	Fat from Scums.	Butter Fat.
Saponification number	223.1	228.5
Iodine absorption number	28.17	33.35
Reichert-Meissl number	30.36	28.3
Melting point	35°	33.2°
Melting point insol. acids	41°	41.7°
Iodine number insol. acids	30.53	29.5

This is the first instance so far as can be found of any other fat, either vegetable or animal, showing such a similarity, as regards the above constants, to butter fat. In certain respects, however, the fat differs from fresh butter fat.

	Fat from Scums.	Butter Fat.
Acid number	85.2	0.50
Ether number	137.9	228.0
Mean mol. wt. soluble acids	129.7	98.1
Mean mol. wt. insoluble acids	283.2	261.0

The distinguishing characteristic of the fat from the scums is the high degree of acidity and the greater preponderance of soluble acids as caproic and caprylic. The high acid number is undoubtedly the result of hydrolysis through a fat splitting enzyme.

It will be impossible at present to take up other interesting fermentations of sugar-cane products, such as that produced by *oiedum lactis*, by the various varieties of *mucor, aspergillus,* and *penicillium,* and by the various kinds of *mycoderms,* or to discuss the character of the products formed by these various organisms. There is one fermentation product, however, which we would like to mention before concluding, as it seems to be of quite common occurrence, although not generally recognized. The substance in question is dimethylketol or acetyl-methyl-carbinol. $CH_3CO\text{-}CHOH\text{-}CH_3$. The compound was first made synthetically by Pechman*; it was discovered later by Grimbert† among the products produced by the fermentation of dextrose, dextrin and mannite by *Bacillus tartricus,* and by Browne‡ among the fermentation products in cider vinegar. Pastereau§ has also recently shown this body to be a common constituent of commercial vinegar. We have again found the same substance in a fermented cane syrup, and it is our belief that this compound is always produced in small amounts whenever the alcoholic fermentation is arrested through the development of oxidizing or acid producing bacteria.

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*Ber. d. Chem. Ges: 21. 2754. 22. 2214.

†Comptes Rendus 132. 706.

‡Jour. Amer. Chem. Soc. 25. p. 31.

§Jour. Pharm Chem. 1905. 21. 593.

It is a mistake to suppose that the fermentation of sugar-cane products is limited entirely to such dilute media as juices and syrups. Molasses is also very susceptible to fermentation, and even raw sugars during transport or in storage may undergo a gradual deterioration through the activity of yeasts and bacteria. The fermentation of such a thick menstruum as molasses, however, is confined entirely to the surface, which, through the attraction of hygroscopic moisture, becomes dilute enough to favor micro-organic growth. The same is true of raw sugars; the film of molasses coating the crystals undergoes a gradual fermentation, with the result that the underlying sucrose is slowly dissolved and inverted.

The deterioration of molasses and sugar during storage is a problem of great importance to the sugar industry, and the following instance may perhaps have an interest for those who are sometimes disposed to hold their sugars for an increase in market value.

In Apirl, 1904, a shipment of Cuban sugars from different plantations was received in New Orleans. The sugars were of the ordinary 96 test type and showed no particular abnormalities. Polarizations were made at the Sugar Experiment Station after unloading and again of the same samples the succeeding winter. The results are given in Table XLVII.

TABLE XLVII.

(Showing deterioration of sugars on standing.)

Plantation—	Polarization— April, 1904.	Polarization— January, 1905.	Decrease.
Jabo	96.50	95.60	0.90
Fajardo	96.05	95.00	1.05
Mercedita Central	95.50	93.20	2.30
Toledo	94.20	91.70	2.50
Ramon	97.15	94.60	2.55
Caridad	93.95	91.10	2.85
Providencia	94.70	91.20	3.50
Mercedita	95.00	91.20	3.80
Nombre de Dios	95.90	91.50	4.40
Avenhoff	96.80	90.70	6.10
Lucia	96.20	89.00	7.20
Average	95.63	92.25	3.38

At the time of the second polarization the sugars had all perceptibly darkened and had acquired a very marked acid reaction. Bacteriological tests showed the number of organisms to vary from 64 to 512 per gram of sugar. The bacteria were largely aerobic in character, and, finding a very suitable medium for growth in the moist film of molasses coating the sugar crystals, produced an inversion which resulted in a decrease in polarization of from 0.1 to 0.8 per cent per month. In the summer the deterioration was, no doubt, much greater than this general average. The thorough drying of commercial sugars intended for storage or long shipment cannot be too strongly enforced, for only in this way can the losses from fermentation be reduced to a minimum.

Louisiana Bulletin No. 92. May, 1907.

AGRICULTURAL EXPERIMENT STATION

OF THE

Louisiana State University
and A. and M. College,

BATON ROUGE.

EXPERIMENTS IN THE LATE PLANTING OF COTTON TO AVOID BOLL WEEVIL DAMAGE DURING 1906.

BY

CHAS. W. FLYNN, Jr.

BATON ROUGE:
The State, Official Journal, State of Louisiana,
1907.

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LETTER OF TRANSMISSION.

Prof. W. R. Dodson, Director, L. S. U. Experiment Stations,
Baton Rouge, La.:

Dear Sir—I beg to transmit herewith a report by Mr. C. W. Flynn, Jr., Assistant Entomologist of the State Crop Pest Commission, upon certain experiments conducted by the Commission in co-operation with the Bureau of Entomology, U. S. Department of Agriculture, during 1906, for the purpose of determining whether general late planting of the cotton crop in regions infested by the boll weevil could reduce the damage by that insect.

The results of these experiments, which were entirely original in their nature, are of value to every cotton planter in the State, as they show the utter fallacy of a rather widely circulated impression that the boll weevil problem can be solved in this way.

I would recommend that this report be published as a bulletin of the Experiment Stations, in accordance with a resolution proposed by Col. Chas. Schuler, Commissioner of Agriculture, and adopted by the State Crop Pest Commission at its meeting April 11, 1907, which resolution provided that the Stations be requested to publish results of experiments by the Commission, etc., when funds therefor cannot be spared out of the Crop Pest Commission appropriation.

Very respectfully,

WILMON NEWELL,

Entomologist, L. S. U. Experiment Stations.

Baton Rouge, La., April 30, 1907.

EXPERIMENTS IN THE LATE PLANTING OF COTTON TO AVOID BOLL WEEVIL DAMAGE, 1906.

BY C. W. FLYNN, JR.

The theory has been frequently advanced that if all cotton were planted late in the season, the majority of hibernated boll weevils would die of starvation and that therefore the damage to the late planted crop by this pest would be small or inappreciable.

The advocates of this theory have maintained that late planting of the cotton would lengthen the period during which the weevil must survive without food, in the same manner that early fall destruction of the cotton stalks lengthens the period through which the weevil must survive until another season's crop makes its appearance.

At first sight the theory appears very plausible, and to test its merits in actual practice experiments were undertaken during 1906 in the late planting of cotton in the boll weevil infested sections of western Louisiana.

As, manifestly, an experiment could not be conducted involving fifty per cent of the cotton-growing territory of the State or which required all planters to plant late, it was necessary to find infested fields isolated by several miles from all other cotton-growing territory. Such fields planted late would present conditions exactly parallel to those which would exist in every cotton field were all the farmers of any parish or any one section of country to adopt the late planting theory and put it into practice.

It could make no difference whether the weevils reached late-planted fields by flying over several miles of forest or vacant fields or over several miles of late-planted cotton. The facts obtained in these experiments therefore show most plainly and forcefully what dire results would follow were individual farmers, or even all of the farmers over an area of several parishes, to plant the cotton crop late in the spring with the cherished hope of outwitting or exterminating the boll weevil.

In two of the parishes longest infested, Vernon and Calcasieu, two isolated fields were selected for these experiments. These fields had been planted in cotton in 1905, and the crop was almost totally destroyed by the weevils.

In selecting these fields, care was taken to secure fields as far from other cotton fields as possible. This was done for the purpose of ascertaining whether these fields would become infested from hibernated weevils surviving the winter and spring, and in the event that the hibernated weevils did not survive, whether the cotton would have an opportunity to make a fairly good crop before becoming infested by the summer and autumn migrations of the weevil.

THE EXPERIMENT IN VERNON PARISH.

The experimental plot consisted of two and one-half acres of good upland soil, situated ten miles to the north of Leesville, just outside of what is known as the "black lands," and by special arrangement was located on the farm of Mr. J. A. Brown. For ten or twelve miles to the north, east and west of the experimental field very little cotton was grown, the nearest field being about four miles away. The only cotton area in this part of the parish lies south of the experiment, the nearest field in this direction being about two and one-half miles.

The experimental field was surrounded by forest, and the two and one-half acres planted in cotton was the only cotton planted on the place.

The land was thoroughly prepared the latter part of May, and the cotton seed planted on June 6th. Fertilizer ("8-2-2") was applied at the rate of 300 pounds per acre, about ten days before planting.

On June 14 the cotton was considered up to a stand and was carefully inspected on this date for boll weevils, but none were found. Failure to find adult weevils on the small cotton at this time could not, however, be taken as evidence that all weevils surviving the winter in and around this field had perished, as it is well known that it is often impossible to find them on cotton before squaring, even in sections which are heavily infested. Nor is there any assurance that all the weevils were out of hibernation at this date, for at Keachie, La., the same spring the last of the hibernating weevils did not leave their winter quarters until June 27 and 28.

On July 21 the cotton in this experimental field had just commenced to square, and 10.4 per cent of the squares were found infested. Adult weevils of the first brood, which can be told by their appearance from the much older weevils that have survived the winter, were also found in this field, and since squares had not been present here long enough for their development, they must necessarily have come from other fields, the nearest of which was two and one-half miles away.

On July 21, for comparison with this experimental field, inspections were made of cotton fields between Mr. Brown's place and Leesville, and the percentage of squares found infested was 28, 24.4, 78, 29.2 and 20.4 in the several fields.

On August 15, 63.6 per cent of the squares in the experimental field were found infested.

The fields along the road between Leesville and the experiment, which were inspected on July 21, were again inspected, and the infestation found to have increased to 99.2 per cent, 98 per cent, 96 per cent, 92.5 per cent and 96.8 per cent, respectively.

According to the owner, Mr. Brown, this same land had in previous seasons produced about 1,200 pounds of seed cotton to the acre, without fertilizer and in spite of the weevil. This late-planted experimental field produced in 1906 but 266 pounds of seed cotton to the acre, even though well fertilized, well cultivated, and despite the fact that seasonable conditions were highly favorable for a large yield. The late planting, therefore, obviously reduced the yield from 1,200 pounds of seed cotton per acre to 266 pounds per acre, a decrease of 934 pounds, or more than half a bale.

THE EXPERIMENT IN CALCASIEU PARISH.

Very little cotton is grown in the vicinity of Merryville; in fact, probably not more than thirty acres were planted within a radius of five miles during 1906. The cotton area of any extent nearest to Merryville is situated around De Ridder, about eighteen miles north. To the east for twelve miles there were no cotton fields, and to the north of the experimental field the first cotton field was located about three miles distant. The nearest cotton field in any direction was south, about two and one-half miles away.

The experiment here was carried out by Steward Willis, a colored farmer highly respected in his community.

The experimental plot consisted of two acres of good upland soil and, like the experiment at Leesville, was fertilized with 300 pounds of ("8-2-2") fertilizer per acre, and planted on June 5th. A dry spell occurred at this time which delayed the germination of the seed, and it was not until the first week in July that a good stand appeared. The weevils made their appearance in the field as soon as the cotton began to square, and by August 23d practically all squares were infested.

Willis states that his land, unfertilized, ordinarily produced from 750 to 1,000 pounds of seed cotton per acre. The 1906 crop, though fertilized and well cultivated, produced but 547 pounds of seed cotton per acre, a loss of from 200 to 450 pounds per acre, as a result of being planted late.

In the case of both these late-planted fields there was nothing to indicate that all the weevils perished of starvation before the cotton came up, nor was there any difficulty in distinguishing the weevils of the first summer brood that came to this field from time to time during June and July from infested fields several miles away, though no defined "migration" took place until in August.

Even leaving this early summer dispersion of the weevils out of account, such late-planted cotton would be literally overrun by the yearly extensive migration of the weevil which takes place in August. The fact that this August migration, in 1906, extended to the infested territory in northern Louisiana fully seventy miles to the eastward shows that even whole parishes or groups of parishes could not fail to experience almost total loss of the cotton crop were this crop uniformly planted late.

Assuming that the late-planted fields had shown an increased production as compared to the fields handled by the cultural methods, the adoption of regulations requiring uniform late planting of the cotton crop would not be practicable, and if enacted such regulations could not be enforced. A law requiring late planting of the cotton crop in Louisiana could not be binding upon planters in the adjacent States of Texas and Arkansas, and under the operation of such a law our sister States would become but boll weevil nurseries to yearly furnish an abundance of weevils for western and northern Louisiana. With the future infestation of Mississippi, the same would hold true along our eastern border.

A majority of the most experienced cotton planters in the State express the opinion that, except in rare instances, only from one-half to three-fourths of a crop can be made if planting is deferred until May 15th or June 1st, even with no boll weevils present. If this be true, it is inconceivable that such late-planted cotton would produce a crop *with* boll weevils to contend with

Baton Rouge, La., April 30, 1907.

Louisiana Bulletin No. 93. June, 1907.

AGRICULTURAL EXPERIMENT STATION

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Louisiana State University
and A. and M. College,

BATON ROUGE.

SECOND REPORT UPON THE HORSEFLIES OF LOUISIANA.

BY

JAS. S. HINE.

BATON ROUGE:
The State, Official Journal, State of Louisiana,
1907.

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LETTER OF TRANSMISSION.

Prof. W. R. Dodson, Director, Louisiana State University Experiment Stations, Baton Rouge, La.:

Dear Sir—During the summer of 1905 Mr. Jas. S. Hine of the State University of Ohio, recognized as an authority upon the group of insects known as ''Tabanidæ'' (horseflies and earflies), was employed jointly by the Gulf Biologic Station and the State Crop Pest Commission to make a preliminary study of these insects in Louisiana.

The fact that outbreaks of anthrax (charbon) spread rapidly when occurring coincidently with a great abundance of horseflies gave rise to the suspicion that these insects were instrumental in spreading the disease. While the observations have not thus far resulted in the actual finding of the anthrax bacillus in or upon the horseflies, much evidence has been accumulated pointing to the relationship sustained by these insects to the spread of this dread disease of live stock and has but emphasized the importance of continuing the investigations until really satisfactory means of control present themselves.

The results of Mr. Hine's investigations during 1905 were published concurrently as Bulletin No. 5 of the Gulf Biologic Station and Circular No. 6 of the Crop Pest Commission. Among other things contained in these publications, measures for protecting animals from the attacks of these insects were given and facts pointing towards ultimate future control of the pests were recited.

During the summer of 1906 Mr. Hine continued his investigation under the direction of the Crop Pest Commission. I beg to hand you herewith Mr. Hine's report upon his investigations of 1906, and would recommend that same be published as Bulletin 93 of the Experiment Stations.

Contrary to what was anticipated, the work during 1906 did not bring to light more than a few additional points of immediate practical application in solving the horsefly problem. On the other hand, the life history studies and extensive observations made by Mr. Hine incidental to his study of the strictly economic phases of the subject have enabled him to prepare what is perhaps the most complete treatise on any group of Louisiana insects yet given to the scientific world.

The present paper is a valuable contribution to entomological science, and forms a solid foundation upon which future investigators can work in pursuing this investigation to a satisfactory conclusion and in solving the horsefly problem, which is of so much importance to the stock raisers of Louisiana.

Respectfully submitted,

WILMON NEWELL,

Entomologist, Louisiana State University Experiment Stations.

BATON ROUGE, LA., March 30, 1907.

PREFACE.

During the winter of 1906, the State Crop Pest Commission outlined a paper entitled "A Preliminary Report on the Horseflies of Louisiana, with a Discussion of Remedies and Natural Enemies." Another season in the field has resulted in adding a number of species of horseflies to the known fauna of the State, as well as in procuring some new facts regarding breeding habits, life histories and natural enemies. The purpose of a second paper is to record these additions, and especially to give a systematic treatise of the species that have actually been taken in Louisiana.

I wish to express my appreciation for courtesies bestowed by the Louisiana State Crop Pest Commission, by whom I was employed during the progress of the work. Mr. Wilmon Newell, the Entomologist, gave numerous suggestions and aided in various ways. Messrs. J. B. Garrett and C. W. Flynn collected several of the species that have been added to the State list as given in a former paper. Messrs. E. C. Cotton and Harper Dean, Jr., aided by taking some of the photographs herein reproduced from half-tones. It is my desire to give all of these full credit for the help they have given me, but as one can hardly enumerate every item of assistance in a paper, it is proper to state that I am under obligations for many more favors than those mentioned or suggested.

Many of the drawings of species of *Tabanus*, herein published for the first time, were made by Mrs. Lumina C. Riddle Smyth of Topeka, Kansas. JAMES S. HINE.

COLUMBUS, OHIO, March 15, 1907.

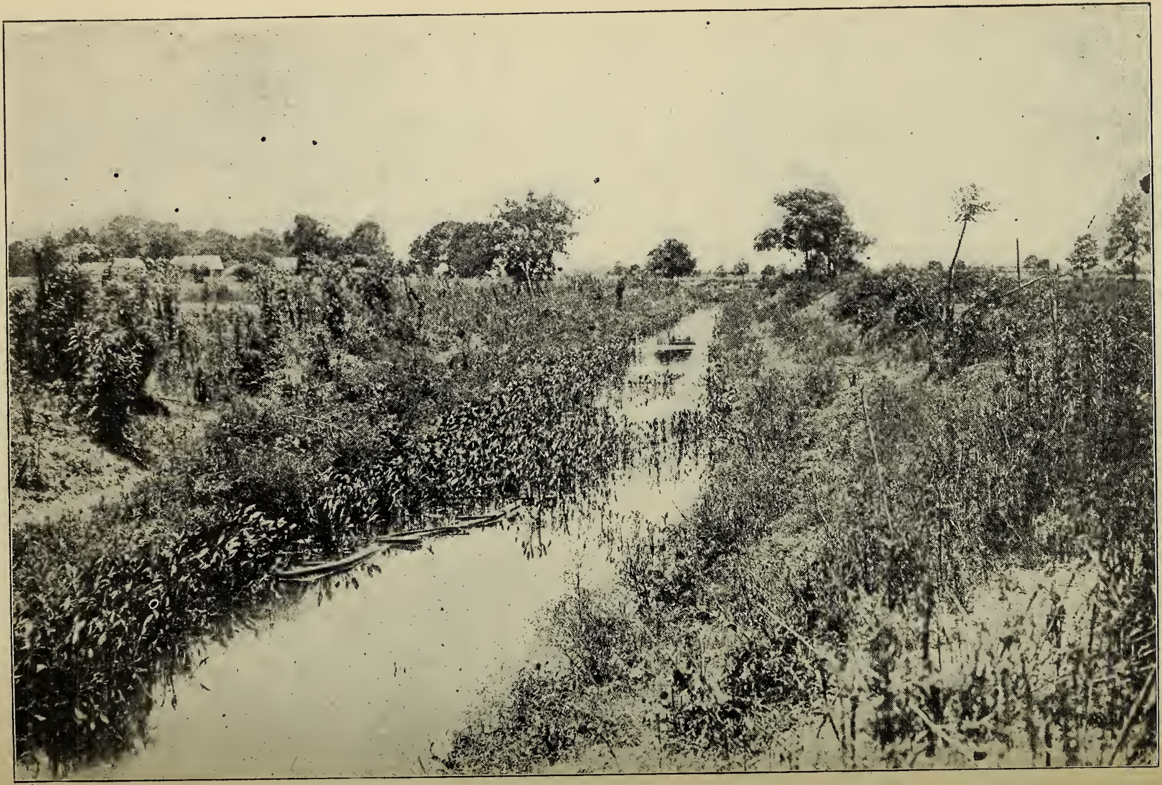

FIG. 1.—A locality near Baton Rouge where the eggs of horseflies were taken in numbers. The plants growing in the water are mostly specimens of *Sagittaria*, on the leaves of which the eggs were found. The horsefly egg-parasite was reared from eggs taken in this locality. (Photo by E. C. Cotton.)

Second Report Upon the Horseflies of Louisiana.

By Jas. S. Hine.

During the summer of 1906 I was in Louisiana from the 10th of June to the 1st of September, and during that time was in several sections of the State and studied the conditions especially favorable to the presence of horseflies. Observation in different localities proved conclusively to my mind that most species of these insects are distinctly partial to wooded areas. In fact, when driving along the roads in well cleared sections only one or two of the species least abundant in the number of individuals caused the team any annoyance, but as soon as woodland was reached, flies were abundant and the horses suffered much in consequence. One species, the black horsefly, appeared to be everywhere, but as this is one which is not usually plentiful, as compared with some of the common species known as greenhead flies, it is not so much to be dreaded by stock as are the others. The American horsefly and a few more are often met with in open fields also.

At New Roads, Pointe Coupee Parish, there is a section of what was once the bed of the Mississippi River, which is now cut off so that it forms a body of standing water, and is called a lake. By wagon road it is said to be nearly twenty-five miles around this lake, and for almost the entire distance the land on the lake front is cleared and under cultivation. It was close to the middle of June when a visit was made to the locality. One could drive a team through the cleared country for hours and scarcely ever see a horsefly, but upon turning to a side road that led through woodland, several species appeared in abundance and caused the team a great deal of annoyance. The insects did not decrease in numbers during the stay in the woods, but were easily left behind upon again returning to the cleared country.

In the State there is plenty of low land that has not been cleared, or anything attempted except, perhaps, to cut off some of the more valuable timber. Such areas are often many square miles in extent and are called swamps. During dry summer months they are accessible to drive through, but it seems that horseflies could not be more abundant than they are, no matter how favorable the conditions for their production. I visited such a swamp near Baton Rouge on June 27th, and since that time have had a much better idea of the injury that may be caused by horseflies than I ever had before. One would fail in an attempt to describe the exact conditions, for to be fully appreciated they must be seen.

The coast region of the State is well supplied with horseflies in season. A trip to Plaquemines Parish July 10th, showed that these insects were very abundant in that section at the date mentioned. The flies were observed to take refuge from the heavy rains that were then occurring, in the orange trees and the clover crops beneath them.

A stay at the Gulf Biologic Station at Cameron, La., for a week resulted in collecting the same species as reported from that section last year and one additional. Mr. McCall, who has been on the ground there for several years, is of the opinion that horseflies were noticeably less plentiful the season through than they were for the past four or five years previous to this one. The opinion seems to prevail that the Horse Guard is accomplishing something toward reducing the numbers of the flies. It is quite evident to my mind that this predaceous insect must be considered an important enemy of horseflies where it is present, and especially where it is so numerous and where conditions are as favorable for its development as at Cameron and in some other of the places visited.

The largest number of species of horseflies from a single locality were taken at Lecompte, in Rapides Parish, from August 23d to 25th. Five species of *Chrysops* and eleven species of *Tabanus*, making sixteen in all, is the record for three days. I do not know how to account for the occurrence of so many species at so late a date except it be that a number of those occurring in early spring are double brooded, thus making it possible for them to appear in late summer at the same time as *Tabanus sulcifrons* and others of the autumn species.

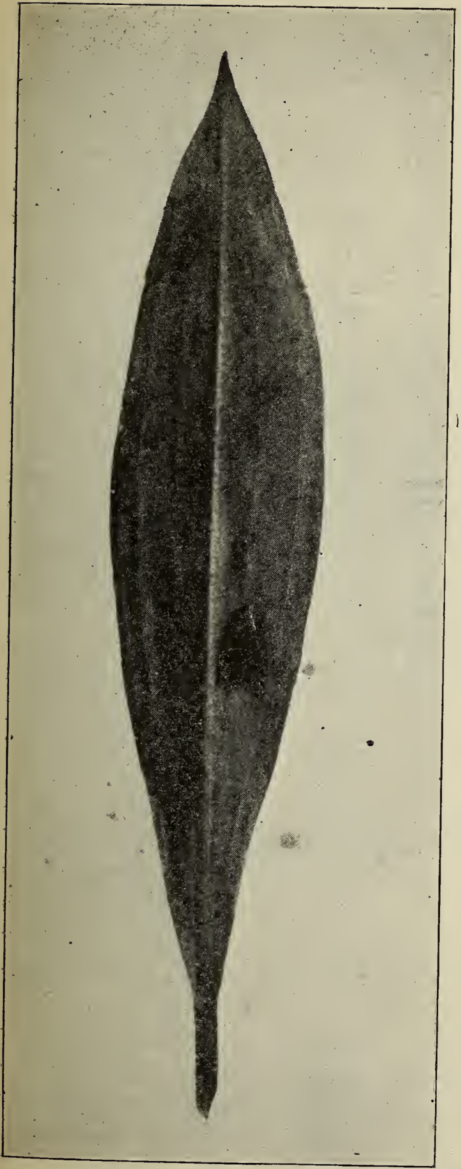

FIG. 2.—The eggs of *Chrysop* placed on a leaf of *Sagittaria*. (Photo by E. C. Cotton.)

Anthrax, which is known as charbon in Louisiana, appeared in various sections of the State during the summer and the result was the loss of many farm animals. It is to be regretted that more definite data is not at hand concerning the part that the Tabanidæ play in the transmission of this disease. That these insects do transmit the charbon with their bites is quite universally believed in all sections. The Experiment Station at Baton Rouge is now carrying on investigations along this line, and it is hoped that reliable experimental data will soon be at hand.

That one can get some idea of the species of horseflies in a locality by making observations while riding through on a train is proven by the fact that no less than ten species were actually recorded as appearing on the windows and other parts of the cars while traveling in the State. I am not prepared to say what attracts them to the train, except it may be the movement. At various times a number of species comprising dozens of specimens were observed following the train and here, it appeared, they would fly for long distances, sometimes for miles, after which they quite often alighted on some part of the car. They appeared to have no difficulty in keeping up in any case observed, so I am sure that it is not impossible for these insects to fly at the rate of at least thirty miles per hour.

It appears like going a long way for relief from horseflies, and perhaps suggesting some seeming impossibilities, to state that Louisiana in all probability will be less and less troubled with the horsefly nuisance as more and more of her territory is cleared and placed under cultivation. It is suggested at the present time that there will always be a great deal of waste land in the State, but I dare say this area will not be so extensive at some future time as present conditions may seem to indicate, and although some species will not be controlled by cutting away the forests, those which are accustomed to confining their operations largely to wooded areas will most certainly be reduced in numbers, as has been the case in other parts of the country where almost all of the land has been placed under cultivation.

THE EGGS OF *CHRYSOPS* AND *TABANUS*.

The eggs of one species of *Chrysops* and at least one species of *Tabanus* were observed several times while in the State. In the latter part of June I located a small stream a mile or two south of Baton Rouge where the flies were ovipositing in numbers. The eggs were placed on leaves of a common water plant known as *Sagittaria,* which margined either bank and in places spread almost across the stream.

The species of *Chrysops* which laid the eggs was proven to be *C. flavidus,* for the females were observed in the act of egg-laying. These are well shown in the illustration, which is from a photograph by E. C. Cotton. This was my first observation of the kind for the particular fly, but nothing peculiar to the species was noted. The mass of eggs is rather large, composed of 200 or more specimens, and attached firmly to the leaf in a single layer. At first this mass is clear white, but gets darker with age and eventually becomes shining black.

As to the species of *Tabanus* which placed its eggs on the leaves of *Sagittaria,* sometimes in close proximity to those of *Chrysops* mentioned, I was not able to conclude. Several large horseflies were observed in the vicinity, but none were found laying. The masses were large, brownish in color and contained nearly 500 specimens. In most cases larvæ appeared the next day or so after the eggs were procured, indicating that they were deposited four or five days before.

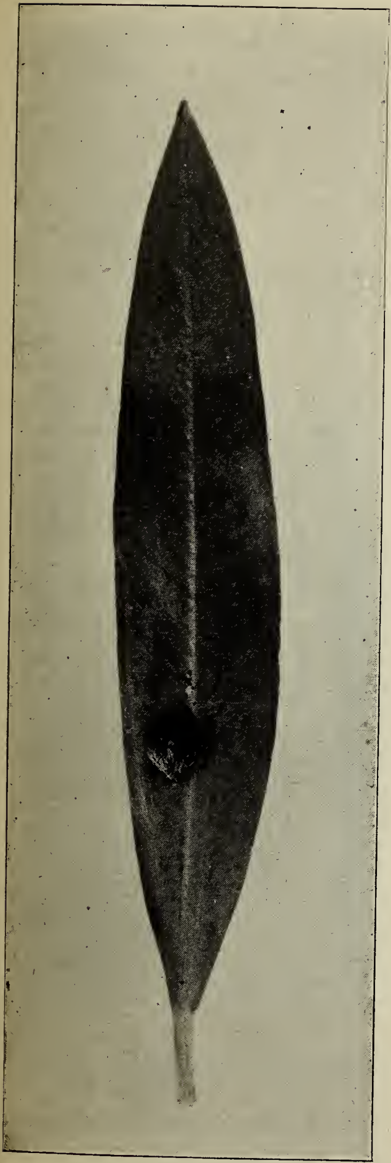

FIG. 3.—The eggs of *Tabanus* placed on a leaf of *Sagittaria.* (Photo by E. C. Cotton.)

THE HORSEFLY EGG-PARASITE, *PHANURUS TABANIVORUS* ASHMEAD.

This little parasite, of the eggs of at least one species of the genus *Tabanus*, is of much interest, and from the range it is now known to have must be of value from an economic standpoint. I am not aware that it has been reared from eggs of any but the black horsefly, but there are strong indications that it has other hosts. At Baton Rouge, on June 22d, were collected three masses of eggs of *Tabanus* like those mentioned above. These were placed in a breeding cage, and after a few days scores of the minute parasites issued, thus indicating that the insect is not rare in Louisiana, and, what is more, I feel almost certain that the material from which the rearing was made was not the eggs of the black horsefly (*Tabanus atratus.*) Since the species is now known from at least three States as widely separated as Illinois, Ohio and Louisiana, it is probable that it is a member of the fauna of a great part of the territory east of the Mississippi River, and no more than likely is to be found west of this river.

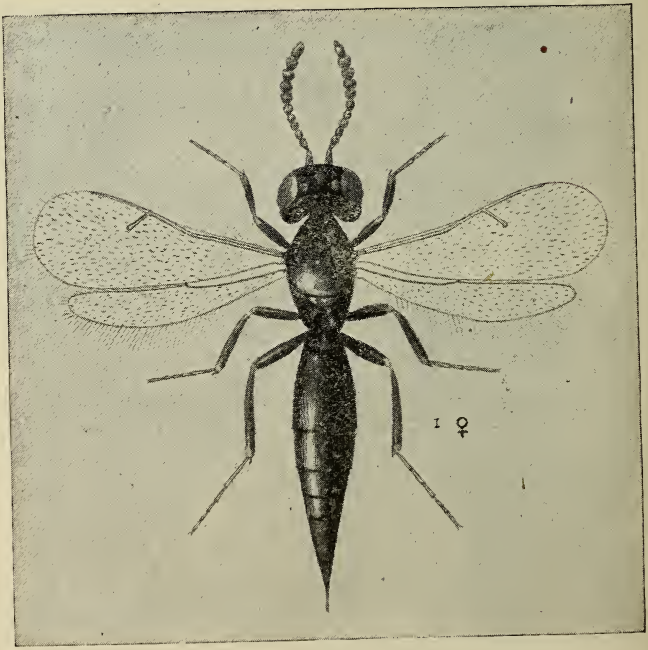

FIG. 4.—Horsefly egg-parasite, *Phanurus tabanivorus*. Much enlarged. (After Hart, Bul. Ills. State Lab., Volume IV.)

It is difficult for some to understand how a parasite so small as the one under consideration can accomplish a noticeable result toward controlling enemies so formidable as are the horseflies, but parasites no larger than this have been known to be of inestimable value. Why not the horsefly egg-parasite?

THE HORSE GUARD, *MONEDULA CAROLINA* DRURY.

This predaceous wasp is found in many parts of Louisiana and several colonies were located and part of them studied. Since the species is considered to be doing noticeable good in reducing horseflies in certain localities, it seems worth while to consider its life history and habits at this time, perhaps repeating some things that were published in my paper last year.

The eggs are white in color, five millimeters in length and about one-fourth as broad; the form is elongate and somewhat curved, making the general outline kidney-shaped. The past summer, during the latter part of July a number of these eggs were procured from the burrows of the wasps, and I am satisfied that no food material is carried into a burrow until the egg hatches. The female watches the nest closely, however, and as soon as the young larvæ appear begins the irksome task of carrying in insects to satisfy the active appetite of her worm-like young. The egg appears to hatch very soon after it is deposited —at least all the eggs taken from burrows were kept in cages and in all cases hatched the next day after they were collected. From this I am not willing to state what the hatching period really is, but from conditions it could not have been more than a few days. The fact that no food is carried into the burrow before the egg is laid, in case of the horse guard, *Monedula carolina,* proves that its habit in this regard is different from its near relative of the same family, *Sphecius speciosa,* for Riley found that the latter species, after digging its nesting burrow, caught and carried in a *Cicada*, upon which to place its eggs.

The wasps do not make all their burrows exactly alike, but usually there is a close resemblance. The first part of the burrow usually goes downward at an angle of about 45 degrees for a few inches, and then a turn is made at nearly right angles to this part. This latter direction is followed until a suitable place for the placing of the egg is reached. The wasp appears to have some notion about drainage, for the end of the burrow is often in the coarsest material to be found; that is to say, instead of the egg being placed in or upon a section of fine sand that has some ability to hold water, such a section is penetrated, and a place for the egg located upon a section composed of small particles of shells and the like.

The observations that it was possible to make this season fully agree with those of last year in that horseflies appear to be a favorite diet of the wasps. Burrows were found in 1905 in which the remains of more than sixty specimens of horseflies were in evidence, and these later observations showed some burrows into which nearly as many had been carried, proving that the habits of the wasps are perpetuated.

Last year I gave an extended account of the habits of the horse guard in its different stages. I believed then that it is an insect which is capable of doing notable work in combating horseflies, and further acquaintance with it has not changed this opinion.

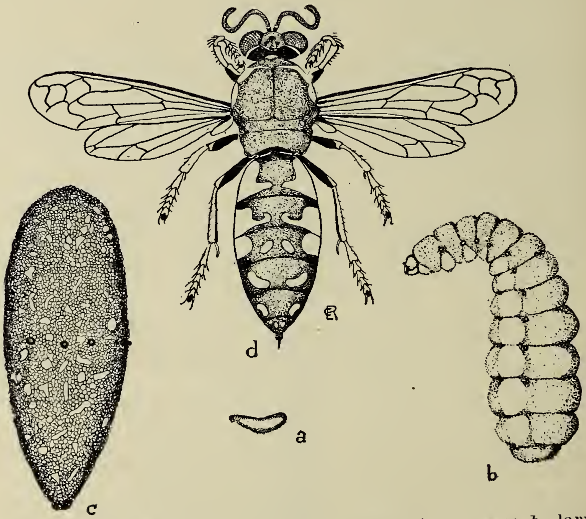

FIG. 5.—Horse guard (*Monedula carolina*) : *a*, egg ; *b*, larva ; *c*, cocoon ; *d*, adult ; enlarged to one and a half diameters.

In traveling over Louisiana one often sees other species of wasps belonging to the same family to which the horse guard belongs. From collections already made in the State it is known that at least seven species of these wasps occur, not in a single locality at the same date, however, for they were taken in different sections and at different dates during my residence of three months. Several of these species were observed to catch flies from horses and cattle, and four were observed to be similar in their nesting habits to the horse guard. I am not able to say whether or not each of the species of the family is as important an enemy of horseflies as is the horse guard, but what I have seen leads me to suspect that some of them are not far behind it when equal numbers are considered.

HORSEFLIES TROUBLE SOME ANIMALS MORE THAN OTHERS.

I am not able to state why horseflies, or other biting flies for that matter, show a preference for some animals, but it is a fact that certain horses or cattle may be attacked and bitten often and severely, while others in the same pasture may be bitten only occasionally. Some animals are more persistent in their efforts to drive flies away, but this does not explain all, for the flies do not attempt to attack some animals as often as others. Neither does difference in color or anything else observed seem to offer a satisfactory explanation as to why the majority of biting flies that are attracted to a herd of animals get a large part of their food from certain animals and only occasionally attack the others.

TERMS USED IN DESCRIBING AND CHARACTERIZING HORSEFLIES.

It is impossible to fully describe a particular species of insect, without bringing into use a term now and then not in use in common language, so in order to explain such terms it seems proper to introduce at this point a few statements concerning the anatomy of the autumn horsefly, *Tabanus sulcifrons,* which is common in parts of Louisiana in season.

HEAD OF FEMALE.—The anterior part of the head is largely occupied by the compound eyes, which are brown in color, and each is crossed by two green bands, quite narrow and slightly curved.

The *antennae* are located on the lower middle of the head, and each is composed of three segments, of which the third bears near the base an angular prominence, which is usually called the upper angle or basal prominence of the third antennal segment. Also this segment is compound, being composed of five rings or annulations, of which the basal one is longer than the other four taken together.

The *front* or *frons,* which is the region between the eyes above the antennæ, is nearly of the same width throughout. The space just above the antennæ, the *subcallus,* is pollinose in this species. Above the subcallus is the *frontal callosity,* which is naked and shining, and occupies nearly the whole width of the lower part of the front. It is quadangular in form, with a narrow, elongate extension upward from its upper side.

The upper part of the front is the *vertex,* and the limit of the front above is the *vertical margin.* The *face* occupies the space bounded by antennæ, eyes and oral margin, or, in other words, is the region between the eyes below the antennæ.

The middle part of the face beneath the antennæ is swollen, while on each side is a less elevated area known as the cheek. The lower part of the face passes to the margin of the mouth, or oral margin, and the *proboscis.* The part of the proboscis which is visible is largely *labium.* This labium is grooved on the upper side, and into the groove the other mouth parts, with the exception of the palps, are received. It may be likened to a sheath, for the edges of the groove are extended and meet above, for at least a part of the length. Its distal part is furnished with an enlargement, the *labellum,* which, when the insect is taking food, becomes a sucking disc.

The mouth parts, which are received into the groove of the labium consist of six stylets, or needle-like parts, which are light brown in color and otherwise resemble one another. If these be separated from the labium, the *labium* may be seen farthest forward, and just behind it the smaller *hypopharynx.* Next in order, passing backward,, are the *mandibles,* placed side by side, while the *maxillae,* the narrowest of the mouth parts, lie posterior to the mandibles. Each maxilla has attached to its base a large *maxillary palp,* which is composed of a shorter basal, and longer distal segment. These maxillary palps, in their natural position, are very prominent; the proximal segment projects forward so that the large distal segment is carried before all the other mouth parts.

The rear of the head is usually referred to simply as the *occiput,* near the middle of which the head is joined to the thorax, a narrow strip lying above this junction being sometimes referred to as the *nape* or *cervix*. The cervix in this species is quite obviously bounded by sutures.

HEAD OF MALE.—The head is larger and approaches nearer to hemispherical than in the female. The eyes are united for a long distance, and thus the front is divided into two parts, called the *vertical* and *frontal triangles.* The former is very small and is bounded above by the vertical margin and bears no *ocelli*, or simple eyes in this species. The latter is limited below by the antennæ and includes the subcallus. Because of the increased size of the head the antennæ appear to have their origin higher up.

The face in this sex is different from that of the female. The sides, or cheeks, are about in the same plane with the surface of the eyes, while the middle part is much depressed. The mouth parts differ also; the mandibles are lacking and some of the other parts are reduced. The second segment of the maxillary palp is smaller and shorter than in the female, and turns upward to lie against the face. The uppermost green band of the eye is abbreviated outwardly, and just above it, next the frontal triangle, is the division between the lower area of small facets and the upper area of enlarged facets of which the eye is composed. On the outer and upper margin of the eye the area of small facets is extended to where the eye meets the vertical triangle.

THORAX.—The three primary divisions of the thorax are not easily separated, but the *mesothorax* comprises nearly all the space visible from above, including the posterior, somewhat triangular portion called the *scutellum.*

The *prothorax* is small but easily located from the fact that it bears the anterior pair of legs. A small lobe of the prothorax, easily distinguished by being lighter in color, is closely applied to each anterior corner, or *humerus,* of the mesothorax. Between the attachment of the anterior leg and the humerus are two small prominences and just posterior to these latter is the *anterior thoracic spiracle.*

The metathorax is small and the *metanotum,* which is the part of it visible from above, may be seen beneath the scutellum by viewing it from behind. Passing downward on each side we observe a prominence on each side called the *lateral callosity* of the metathorax. Behind the lateral callosities are located the *poisers* or *halteres*, and just beneath them the posterior thoracic spiracles.

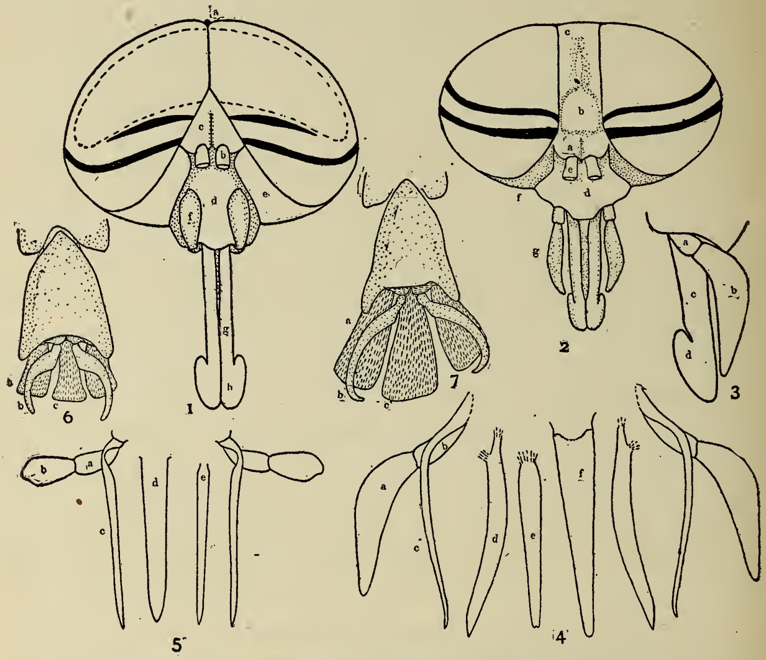

FIG. 6.—All the drawings were taken from *Tabanus sulcifrons.*

1. Anterior view of the head of the male. The greater part of this view is occupied by the compound eyes, on the surface of which are to be seen the transverse green bands, which are represented by heavy black lines. The space included within the dotted lines represents the location of the enlarged facets. a, vertical triangle; b, first segment of one of the antennæ; c, frontal triangle; a plus c compose the front; d and e, face; e, cheek; f, one of the maxillary palpi; g, probosis; h, labella.

2. Anterior view of the head of the female. c, front, which includes all the space down as far as the base of the antennæ; b, frontal callosity with linear extension above; a, subcallus; d and f, face; f, cheek; e, basal segment of one of the antennæ; g, maxillary palpus.

3. Side view of the proboscis and maxillary palpus of the female. c, proboscis; d, labella; a, basal segment; b, apical segment of the maxillary palpus.

4. Mouth parts of the female. a, apical segment; b, basal segment of the maxillary palpus; c, maxilla; d, mandible; e, hypopharnyx; f, labrum.

5. Mouth parts of the male. a, b, maxillary palpus; c, maxilla; d, labrum; e, hypopharnyx.

6. Last segment of female front tarsus. a, pulvillus; b, claw; c, empodium.

7. Last segment of male front tarsus. Lettered as in number 6.

The prothorax bears the front pair of legs, the mesothorax the middle pair of legs and the wings, and the metathorax the posterior pair of legs and the halteres.

The legs are each composed of five sections; the *coxa,* next the thorax, and following in succession the *trochanter,* a very short segment, the *femur, tibia* and *tarsus.* Each tarsus contains five segments, of which the fifth or last bears a pair of claws, a pair of pads, or *pulvilli,* beneath the claws, and between the pulvilli a single *empodium,* which is like the pulvilli in appearance. The prothoracic coxæ are slightly more than half as long as the femora of these legs, while the coxæ of the other legs are very much shorter.

There is no notable difference between the legs of the male and female, except in the front feet the male claws, pulvilli and empodia are larger than in the female.

By taking a specimen of *Tabanus* with wing spread and following the posterior border of this wing toward the body, one finds toward the base an incision, the *axillary incision,* between which and the scutellum are three membranous lobes. These, in order, are called *allula, antitegula* and *tegula.*

The allula, bordering the axillary incision, is considered as a part of the wing proper, but the other two, called tegulæ when taken together, are usually considered as accessory. In closing the wing the antitegula moves with the wing, while the tegula, which, although joined to the antitegula, is also securely joined to the thorax, remains practically stationary. When the wing is closed the antitegula fits over the tegula and nearly hides it from view. The halteres have their attachment beneath the tegula on each side; therefore their basal parts are concealed, but the knob-like apical parts are always visible.

The wing contains a number of characters which are of value in classification. In order that the various parts of the wing may be referred to it is necessary to have an acquaintance with the veins and cells of which it is composed. It is easiest to make these plain by means of a drawing prepared for this purpose, so a detailed description will not be attempted in this place.

Many species of *Tabanus* have their wings entirely transparent, while others have dark areas which furnish distinctive characters. In *T. sulcifrons* dark markings are located at the furcation of the third vein and along the veins at the distal end of the discal cell; when markings are present on the wings of various species of *Tabanus* it is more common to find them where

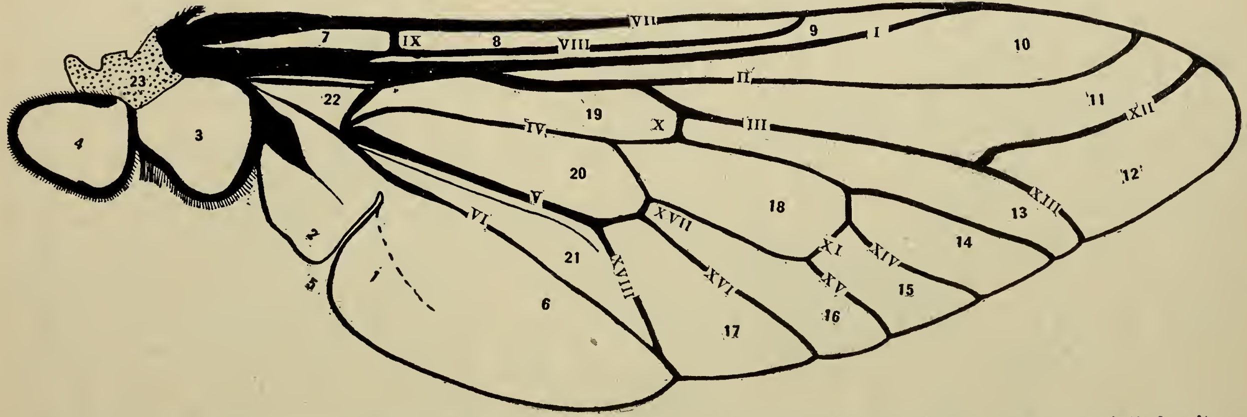

FIG. 7.—Wing of a horsefly, *Tabanus stygius*: I, II, III, IV, V, VI, first, **second**, third, fourth, fifth and sixth longitudinal veins, respectively; VII, costa or costal vein; VIII, auxiliary vein; IX, humeral cross-vein; X, small cross-vein; XI, posterior cross-vein; XII, anterior branch of the third vein; XIII, posterior branch of the third vein; XIV and XV, second and third branch of the fouth vein, respectively; XVI and XVIII, first and second branch of the first vein, respectively; XVII, basal cross vein; 1, anal angle; 2, alula; 3, antitegula; 4, tegula; 5, axiliary incision; 6, axiliary cell; 7, 8, 9, first, second and third costal cells respectively, or costal cell; 10, marginal cell; 11 and 12, first and second submarginal cells, respectively; 13, 14, 15, 16 and 17, first, second, third, fourth and fifth posterior cells, respectively; 18, discal cell; 19 and 20, first and second basal cells, respectively; 21, anal cell; 22, humeral cell; 23, small section of the thorax, to which the wing is attached.

the third vein branches and along the veins or parts of veins which are most nearly transverse. Exceptions to this may be seen by reference to *T. venustus* and *turbidus.*

ABDOMEN.—The markings of the abdomen in *T. sulcifrons* consist of rather broad white triangles and white posterior margins on most of the segments. These markings are formed by the color and arrangement of the vestiture of the body. This vestiture is easily rubbed off in most specimens, and in case it is rubbed off the appearance of a specimen is much changed and rendered difficult of determination. Therefore care should be used in collecting material which it is desired to determine.

Seven abdominal segments are visible to the unaided eye. The circumference decreases from the second backward, and concealed by the seventh are what may be considered as three very much reduced additional segments, which are easily removed by aid of a needle, and which can only be differentiated satisfactorily by the use of a microscope or strong lense.

A BRIEF STATEMENT OF THE CHARACTERS OF THE FAMILY *TABANIDAE.*

As a usual thing the horseflies are easily recognized at sight by their habits, form and general appearance. The accompanying drawings will serve to get the form and structure of these insects fixed in the mind of the reader. It is the aim to figure nearly all the characters referred to in the text, consequently frequent reference to these figures will be found profitable, in case the names used are unfamiliar or not self-explanatory.

The antennæ are each composed of three segments. The third segment is composed of rings or annulations, but has no style or arista, like that found in the house fly.

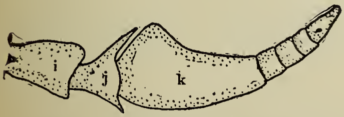

FIG. 8.—Antenna of *Tabanus,* showing the three segments, with the third segment composed of five rings: *i, j, k,* first, second and third segments, respectively.

Each foot is composed of five segments, and the fifth bears a pair of claws and three cushion-like pads beneath the claws. The two outer of these pads are known as the pulvilli and the middle one as the empodium. Thus the empodia are pulvilliform, as some authors state it.

None of the species are really small; the head is large, larger and hemispherical in the male, smaller and somewhat flattened in the female.

The eyes are separated in the female and united in the male. They have an area of enlarged facets above, in the males of many species, and in living specimens of both sexes are marked with green and purple markings. Simple eyes are present in some species, but in others are absent. The proboscis projects, being much elongated in some species, and the maxillary palps are large and two-segmented.

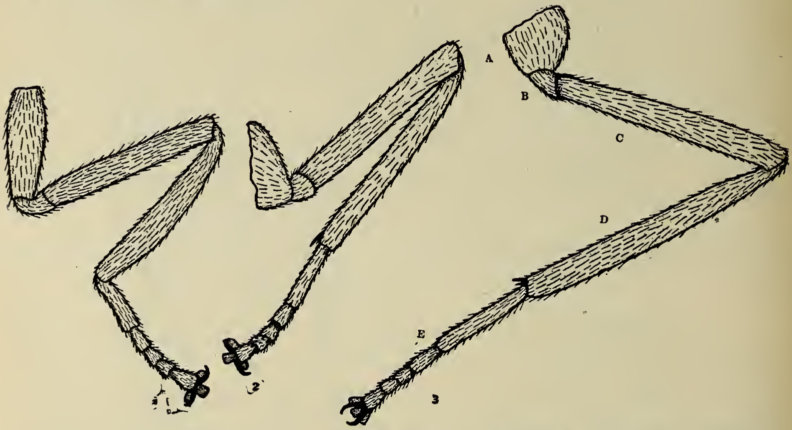

FIG. 9.—1, anterior leg; 2, middle leg; 3, posterior leg; all of *Chrysops*. *A*, coxa; *B*, trochanter; *C*, femur; *D*, tibia; *E*, tarsus, composed of five segments. (Note the spines at the distal ends of the middle and posterior tibiæ.)

The wings are rather large and encompassed by the marginal vein, two submarginal and five posterior cells present, basal cells elongate, anal cell usually, and sometimes some of the posterior cells, closed. Abdomen composed of seven visible segments, broad, never constricted.

KEY TO THE GENERA OF *TABANIDAE* FOUND IN UNITED STATES.

1. Hind tibiæ with spurs at tip........................ 2
   Hind tibia without spurs at tip........................ 6
2. Third segment of the antenna composed of eight rings, the first of which is only a little longer than the following ones........................ 3

Third segment of the antenna composed of only five rings, the first of which is much longer than any of the following ones.. 5

3. Front of the female narrow; simple eyes present or absent; fourth posterior cell at least open.........*Pangonia*

Front of female broad with a large denuded callus; ocelli present 4

4. Eyes in the female not acutely angulated above; wing in both sexes hyaline...........................*Apatolestes*

Eyes in the female acutely angulated above, wing in both sexes with a dark picture.......................*Goniops*

5. Second segment of the antenna about half as long as the first; eyes in life with numerous small dots........*Silvius*

Second segment of the antenna as long as or but little shorter than the first; eyes in life with irregular green patches ....*Chrysops*

6. Third segment of the antenna with a well-developed basal process ....*Tabanus*

Third segment of the antenna without, or with only a rudimentary basal process.......................... 7

7. Front in the female as broad as long, the callus transverse ....*Haematopota*

Front of the female narrow....................*Diachlorus*

So far only two of the above genera, *Chrysops* and *Tabanus*, are known from Louisiana, but three others, *Pangonia*, *Silvius* and *Diachlorus*, have been taken in adjoining states. In the United States, *Pangonia* is represented by several species, but *Silvius* and *Diachlorus* are small genera, the former of three and the latter of a single species. It is probable that one or more of the three genera last mentioned will be taken in Louisiana in the future. There should have been more early spring collecting with the species of these genera in mind, so that more definite statements could have been made in regard to them.

THE GENUS *CHRYSOPS*.

Of the 40 species of horseflies collected in Louisiana, 13 belong to the genus *Chrysops*. These flies are medium-sized species with green markings on the eyes in life and usually with wings hyaline and black or brown. It sometimes happens that the males and females of a species are very different in appearance, but as a usual thing the sexes are so nearly alike that they are quite easily associated, especially when both are taken in the same locality. They are distinguished from members of the genus *Tabanus* quite readily by their smaller size, but in a few cases size is not a safe guide to follow. In all cases the spines at the end of the hind tibiæ and the absence of a process at the base of the third antennal segment are distinctive, and reference to the accompanying figures will aid one in deciding the presence or absence of these characters. Simple eyes, or ocelli, are present in all species of *Chrysops,* but are at most only indicated in the species of *Tabanus.* The coloration of the wing is quite constant in each species, so this is relied upon to a large extent in the following descriptions of the various species. In order to locate these colors properly the names of the cells of the wing are often referred to. These cells have the same appearance and name as in the species of *Tabanus,* a wing of which, with the veins and cells numbered and named, is figured on a previous page. On ac-

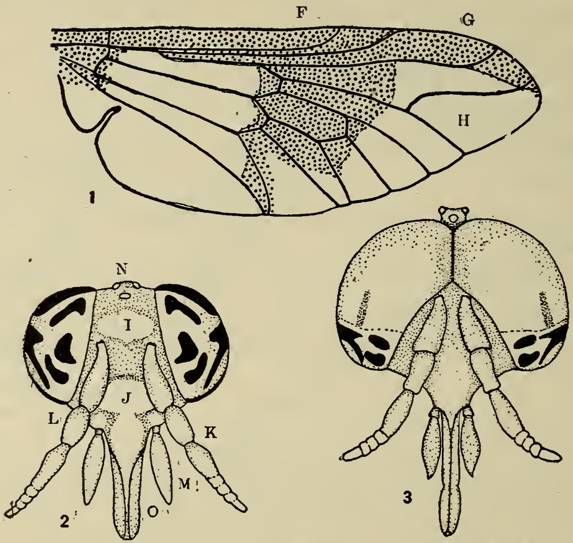

FIG. 10.—1, wing of *Chrysops*: *F*, cross-band; *G*, apical spot; *H*, hyaline triangle. 2 and 3, front of the head of male and female *Chrysops*, respectively: *I*, frontal callosity; *J*, facial callosity; *K* and *L*, antennæ; *M*, palpus; *O*, proboscis. (Note the spotting of the compound eyes, which are shown as seen in the living specimen.)

count of the constant pattern of the color of the wing of *Chrysops* it is possible to give definite names to various regions; consequently "cross-band," "apical spot" and "hyaline triangle" are terms often appearing in the descriptions. Reference to the accompanying wing drawing will make these points clear. The color of the abdomen is often referred to, and it will be noted that the abdomen is made up of segments, which are numbered from one to seven, beginning with one next to the thorax.

KEY TO THE LOUISIANA SPECIES OF *CHRYSOPS*.

1. Hyaline triangle represented by a small spot mostly in the first submarginal cell.................. *bistellatus*
Hyaline triangle not confined to a small spot but reaching the posterior border of the wing.......... 2
2. Whole body brown............................ 3
Abdomen and wings marked with clear black... ... 4
3. Abdomen brown with small yellow triangles on the segments above............................ *brunneus*
Abdomen pale at base and followed by dark brown; posterior border of each segment pale.......... *flavidus*
4. Both basal cells of the wing hyaline................. 5
First basal cell black............................ 8
5. Abdomen black with a mid-dorsal yellow stripe... *obsoletus*
Abdomen not so colored........................... 6
6. Cross-band of the wing very narrow or lacking altogether .... *fulvistigma*
Cross-band of the wing normal, abdominal segments with gray hind borders.......................... 7
7. Apical spot narrow, extreme apex of the first submarginal cell black............................ *callidus*
Apical spot wider, the greater part of the apical half of the first submarginal cell black............ *pudicus*
8. Hyaline triangle confined to the apices of the second and third posterior cells.................. *moechus*
Hyaline triangle reaching across the first posterior cell. 9
9. Apical spot not reaching beyond the second submarginal cell.................................. *vittatus*
Apical spot large, invading the first posterior cell..... 10
10. Abdomen with four black stripes.................. 11

Abdomen not marked.............................. 12
11. Black stripes reaching the whole length of the abdomen ....*sequax*
Two middle black stripes entire, two outer ones not present on the first and second segments...........*pikei*
12. Abdomen with a broad yellow stripe enclosed between two black areas............................*univittatus*
Abdomen uniformly black, or black with three yellow stripes ....*lugens*

DESCRIPTION OF LOUISIANA SPECIES OF *CHRYSOPS*.

CHRYSOPS BISTELLATUS DAECKE.—Length 8 millimeters. Face and facial callosities yellow, frontal callus black. First antennal segment yellow, second and base of third brownish, annulate portion of the third black. Thorax vittate with light colored stripes alternating with dark ones. The wing is largely black, the hyaline triangle being represented by a small spot located near the furcation of the third vein, mostly in the first submarginal cell. Nearly the entire first basal, anal and axillary cells are hyaline, as is the base of the fifth posterior. Legs with much yellow, anterior tibiæ, apices of other tibiæ and all the tarsi brownish. Abdomen largely yellow, a rather wide mid-dorsal yellow stripe bounded on each side by a somewhat diffuse black stripe. In the Louisiana specimen the last two segments of the abdomen are entirely blackish.

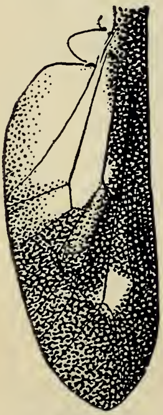

FIG. 11.—Wing of *Chrysops bistellatus*. Enlarged. (After Daecke, Entomological News, Vol. XVI.)

The species was described a year or so ago and was known only from New Jersey before it was collected by C. W. Flynn at Merryville, Louisiana, on June 16, 1906. Nothing was learned regarding the habits of the species except that the specimen procured was taken while biting a horse.

CHRYSOPS BRUNNEUS HINE.—Length 8-10 millimeters. Antennæ noticeably longer and the first two segments thicker than in *flavidus*; first and second segments brown; third yellow at the base with apical half black; thorax with four grayish longitudinal stripes separated by brown intervals. The apical spot spreads over a large part of the apex of the wing, fading out so gradually that the real extent of it is not clearly defined; a narrow whitish hyaline band is conspicuous along the distal margin of the cross-band and occupies part of each of the first submarginal and first, second and third posterior cells; the cross-band fills out the fourth posterior cell and invades the fifth posterior; the margin of the posterior branch of the fifth vein spreads across the apex at the anal cell and communicates somewhat with the cross-band; the first basal cell is infuscated for two-thirds, and the second for about half the length.

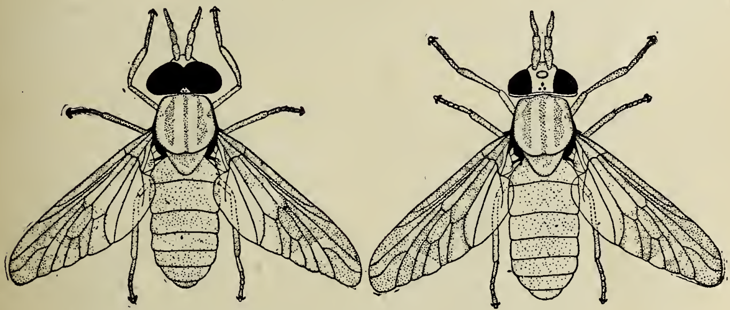

FIG. 12.—*Chrysops brunneus*, male and female.

The abdomen is clear brown, often with very small yellowish triangles in the middle of the posterior part of segments two to five.

The male and female are alike, differing only in sexual characters.

The species is separated from *flavidus* by the following: The antennæ are longer and have the first two segments thicker and the third colored differently at base. The basal cells are more infuscated, the apical spot less clearly defined and the abdomen more uniformly colored. In *flavidus* the abdomen is distinctly lighter in color at base, but not so in *brunneus*.

It has been reported from Ohio, New Jersey and New York. The past summer specimens were taken at Buras and Cameron, in Louisiana. It is a marsh species where I have observed it, and is one of the most persistent species of its genus. Abundant at any time of the day, but perhaps most numerous in the evening, and its attacks are prolonged till almost dark in warm weather.

CHRYSOPS CALLIDUS OSTEN SACKEN.—Length, 7-9 millimeters. The width of the apical spot is equal to the distance between the costa and the second vein at the distal end of the first vein. First two segments of the abdomen yellow on the sides, and this color on the second is not encroached upon by a black triangle. Basal half or more of the venter of the abdomen plainly yellowish, but with dark stripe or some dark spots on the mid-ventral line.

Female: Frontal callosity black; facial callosity yellow; both basal cells hyaline; dorsally the abdominal segments with narrow, yellow hind margins, which expand into triangles in the middle; none of these triangles extend forward far enough to entirely divide the black of any of the segments. Lateral margins of the segments behind the third black.

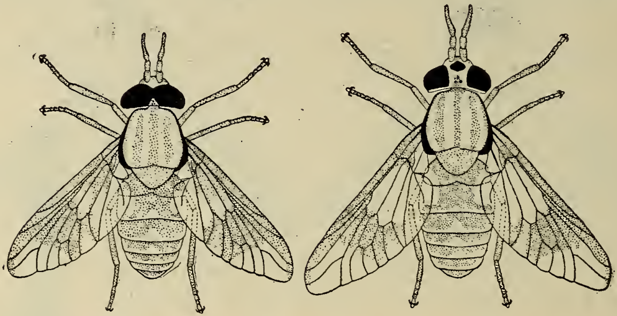

FIG. 13.—*Chrysops callidus,* male and female. Enlarged.

Male: Both basal cells with about the apical third hyaline; the yellow on the sides of the first two abdominal segments is more prominent and the posterior margins of all the segments wider than in the male of *moerens.*

A common fly over most of the eastern part of the United States. Taken at Keachie, Louisiana, May 23, 1906, by J. B. Garrett. Appears to be a spring species where I have seen it, and an important stock pest at that season of the year. The eggs are laid on foliage over water along canals and the margins of ponds. The males have been procured from flowers and swept from vegetation growing near water.

CHRYSOPS FLAVIDUS WIEDEMANN.—Length 7-10 millimeters. First two segments of antennæ yellowish, not noticeably thickened; basal part of third segment yellowish, with an obscure brown band on its thickest part, apical half black; the thorax has four grayish longitudinal stripes separated by brown intervals; the parts of the wing not occupied by brown are grayish hyaline, and not clear, as in most species; the hyaline triangle reaches forward to the middle of the first submarginal cell and includes about half of the second submarginal and parts of the first three posterior cells; the cross-band fills out the fourth posterior cell; the apex of the anal and part of the fifth posterior are infuscated; usually the apical half of the first basal cell and two-thirds of the second basal are hyaline, but some variation is allowable; dorsally the abdomen is brownish, lighter on the first segment and sides of second, and segments two, three and four have a prominent gray triangle in the middle of the posterior part, preceded by a dark area, which usually takes the form of a geminate spot; the anterior margins of the last three segments are black or brown, the dark markings of the abdomen are somewhat variable.

The male and female are alike, except fully half of the second basal cell is brown.

Common over a large part of the eastern United States as far west as Ohio. In Louisiana the species was taken or observed in every section of the State visited. Abundant in Plaquemines Parish the first part of July and plentiful in Rapides Parish the latter part of August. On account of its abundance the species was one of the worst stock pests of its genus observed during my stay in Louisiana. Females were seen laying eggs on leaves of *Sagittaria* growing in shallow water at Baton Rouge in July.

CHRYSOPS FULVISTIGMA HINE.—Length about seven millimeters. Palpi yellowish, antennæ slender, first segment yellowish, slightly darker at apex, second and third segments brown, annulate portion nearly black. Face shining black, covered next the eyes and on the anterior parts of the cheeks with yellowish gray pollen. Front yellowish gray, pollinose, callosity and region surrounding the ocelli shining black. Thorax dark, nearly black, with grayish pollen above, giving the impression of stripes before the suture; coxa, basal two-thirds of femur and base of tibia of the anterior leg, and nearly the whole tibia and base of tarsus of middle leg, yellow; remainder of legs dark, nearly black. Wing almost hyaline, costal margin from base to apex and a very narrow cross-band, abbreviated behind, pale brownish, or black in some specimens, stigma conspicuous. Abdomen yellow at the base, black at apex. Dorsally, a large, nearly square, black spot beneath the scutellum, reaching the posterior margin of the first segment. Second segment with a large black triangle with its base on the posterior margin and sometimes encroached upon by a small yellow triangle within it. The remainder of the abdomen above is black, but in some specimens the third segment has a small yellow triangle. Ventrally the first two segments are mostly yellow, the exception being a linear, black spot on each lateral margin, and a suggestion of the same color at middle. The yellow also extends back on to the third segment on each side of the midventral line.

Known from North Carolina. Taken at Keachie, Louisiana, May 29, 1906, by J. B. Garrett, and at Osborn, Louisiana, July 19, by E. C. Cotton.

CHRYSOPS LUGENS WIEDEMANN.—Length 8-9 millimeters. First segment of the antennæ yellow, second variable, but usually yellow, third black, face yellow, its lateral callosities black; the hyaline triangle of the wing does not cross the second longitudinal vein; the apical spot includes nearly all of the second submarginal and the apex of the first posterior cells, so that the triangle is narrow and may be said to be lunate; the abdomen is wholly black above or marked on the basal part with three yellow longitudinal stripes.

Female: Frontal callosity black; thorax dorsally with two greenish gray stripes, narrowly separated by brown, first basal cell brown, second hyaline; the cross-band fills out the fourth posterior cell; posterior branch of the fifth vein obscurely margined.

Male: Medium stripes of the thorax more yellow than in the female; second basal, fifth posterior, and anal cells largely infuscated; to the unaided eye a subhyaline streak is visible beginning at the margin of the wing and passing the length of the fifth submarginal cell into the second basal and thence toward, but not attaining, the base of the cell; this sex is much like the female and easily associated with it.

Known from Maryland, North Carolina, Georgia, Florida, New Jersey, Ohio and other States. Specimens were taken at Keachie, Louisiana, by J. B. Garrett in May and June, 1906. It is variable, especially in the color of the abdomen; thus specimens from different parts of the country, and even from the same locality, when placed together have the appearance of different species mixed up. The wing markings are quite constant, however, and as these are characteristic for the species, it is not difficult to determine. The hyaline triangle is narrow and reaches the second vein, and the outer margin of the cross-band is evenly curved, thus giving the wing a mark by which the species may always be known. I have never seen this species as abundant as I have some others at times, but it can bite severely, and when numbers of the specimens are considered, is as injurious as any other.

CHRYSOPS MOECHUS OSTEN SACKEN.—Length 8 millimeters. Hyaline triangle of the wing very small, occupying only part of the second and third posterior cells.

Female: Face, palpi and base of antennæ yellow, frontal callosity black; first basal cell of wing infuscated, second hyaline, except a margin along the vein which separates it from the first, the cross-band reaches the posterior margin, filling out the fourth posterior cell; in the fifth posterior cell there is a margin along the posterior intercallary vein, and also along the posterior

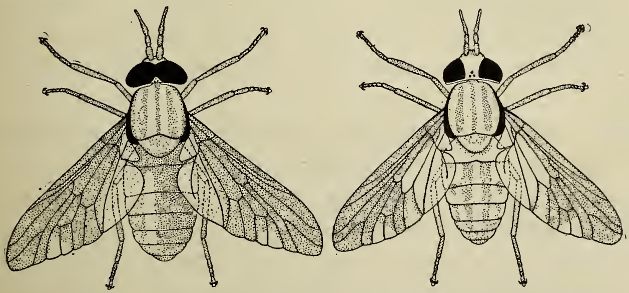

FIG. 14.—*Chrysops moechus,* male and female. Enlarged.

branch of the fifth; the apex of the anal cell is slightly infuscated; dorsally the markings of the abdomen are variable, but four longitudinal rows of dark spots are usually visible.

Male: Face yellow, otherwise whole body, including most of the wings, black; the only trace of hyaline in the basal cells is a dot on the fourth vein near the base of the discal cell.

Known from New Jersey, Ohio, Illinois, Kentucky and other states. Taken at Many, Louisiana, June 12, 1906, by C. W. Flynn. The very small hyaline triangle which is confined to the apices of the second and third posterior cells, serves to distinguish the species from others, and also to associate the sexes, which are strikingly different in coloration.

CHRYSOPS OBSOLETUS WIEDEMANN.—Length 7-8 millimeters. Basal segments of antennæ yellow, second and third segments usually black, although the second is sometimes yellowish; face yellow, its lateral callosities black; thorax above with two medium greenish gray stripes narrowly separated by brown; the hyaline triangle of the wing crosses the second longitudinal vein and in most specimens reaches the costa; the apical spot is confined to the distal parts of the marginal and first and second submarginal cells; the cross-band nearly fills out the fourth posterior cell, leaving only an obsolete margin at its apex.

Female: Frontal callosity black, both basal cells hyaline; dorsally, abdomen black with a yellow mid-dorsal stripe on the first four segments; variations occur in which an additional yellow stripe is present on either side of the mid-dorsal one, and in some specimens the first two segments are narrowly yellow on the sides.

Male: Several specimens of this sex have the first basal cell infuscated and the abdomen black above with the single mid-dorsal yellow stripe; otherwise like the female.

This fly has been taken in many of the states from Maine to Louisiana and west to Kansas. Mr. Wilmon Newell collected it in Rapides Parish in September, 1905, and this year it was procured at Slidell and at LeCompte in July and August, respectively. At the latter place it was common and showed its ability to bite by attacking myself and team continually. According to observations the species is partial to woodland and any animals that visit such places are sure to know of its presence.

CHRYSOPS PIKEI WHITNEY.—Length 6-8 millimeters. Face yellow, the callosities infuscated outwardly. First segment of the antennæ yellow, second slightly infuscated, the third dark. Thorax black, with well defined greenish yellow stripes. First basal cell infuscated except a small hyaline spot contiguous to a spot in the discal cell; the second basal, anal, axillary and fifth posterior cells are largely hyaline; the cross-band reaches the hind margin, completely filling out the fourth posterior cell. The apical spot extends across both submarginal cells and invades the first posterior. The hyaline triangle does not cross the second longitudinal vein, and is almost as wide contiguous to that vein as at the posterior margin of the wing. Abdomen yellow, with two broad black median stripes the entire length, and two narrow abbreviated lateral stripes beginning on the third segment. The sixth segment is mostly black. Venter yellow, with slender furcate lateral lines and an abbreviated median stripe black.

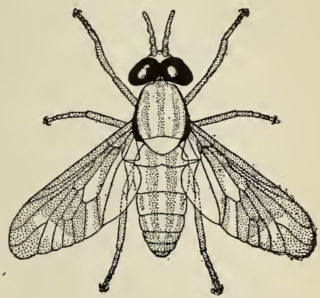

FIG. 15.—Little earfly, *Chrysops pikei,* female. Enlarged.

This species is known from Missouri, Kansas and Ohio. It is very common in different sections of Louisiana, where it has been taken by various collectors. It attacks animals very persistently, and if any of the flies are in a locality they are pretty sure to be found on some horse's ears.

CHRYSOPS PUDICUS OSTEN SACKEN.—Length 8 millimeters. Face, including its callosities and the palpi, yellow. First two segments of the antenna and base of the third yellow, annulate portion of the third black, frontal callosity reddish with a black margin, thorax vittate in the usual way. Both basal cells of the wing hyaline with the exception of a slight infuscation of each at base, costal cells brown, cross-band reaching the hind margin of the wing, filling out the fourth posterior cell, vein between the fifth posterior and anal cells margined with brown. The hyaline triangle does not reach anteriorly across the second longitudinal vein, the apical spot fills out the greater part of the distal half of the first submarginal cell and extends to the apex of the wing. Abdomen largely black, first and second segments yellow on the sides, and on the second the yellow reaches across on the anterior margin. On the middorsal line there is a row of triangles in contact with yellow posterior margins of the segments.

The species is known on the Atlantic coast from New York to Florida, but is not common at any particular place so far as reported. Taken at Frierson, Louisiana, July 14, 1905.

CHRYSOPS SEQUAX WILLISTON.—Length 8 millimeters. First two segments of the antennæ yellow, the third black. In many specimens the frontal callosity is black, but in others it is yellow, face, including the callosities, reddish yellow. Thorax with four narrow yellow stripes separated by black ones. The first basal cell of the wing is brown, the cross-band reaches the posterior border of the wing, thus filling out the fourth posterior cell, the hyaline triangle is produced forward across the second longitudinal vein and the apical spot includes the larger part of the apical half of the first submarginal cell, almost all the second submarginal, and invades the first posterior. Abdomen with four narrow black stripes reaching the whole length and separated by yellow intervals of nearly the same width.

The species has somewhat the aspect of *univittatus* or *striatus*. It is separated from the latter by the hyaline triangle reaching or slightly transcending the second longitudinal vein, and the apical spot entering the first posterior cell, and from the former by the coloration of the abdomen.

Known from Kansas, North Carolina and New Jersey. Taken at LeCompte, Louisiana, August 25, 1906. I have never seen the species numerous enough to be a pest, but it has been taken from horses, and therefore its habits are similar to its near relatives.

CHRYSOPS UNIVITTATUS MACQUART.—Length 6-8 millimeters. Basal segment of antennæ yellow, second a little darker, and third nearly black; hyaline triangle of the wing reaches or nearly reaches the second vein; the apical spot is large, occupying all the marginal cell beyond the cross-band, the broad apex of the first submarginal, all the second submarginal except a small patch at base and the apex of the first posterior; the cross-band entirely fills out the fourth posterior cell.

Female: Frontal callosity black, face yellow, its lateral callosities brown or black; first basal cell brown; second basal cell with a very little brown at base; posterior branch of the fifth vein narrowly margined with brown, abdomen with a middorsal yellow, longitudinal stripe with a black stripe of about the same width on either side of it; outside the black stripes the abdomen may be entirely yellow, or all but the first two segments may be dull black, or there may be a narrow black stripe beginning on the third segment and continuing on to the fourth and fifth segments; the last three abdominal segments are often blackish, obscuring all stripes in that region.

Male: Second basal cell of wing brown on its basal two-thirds and the fifth posterior more brown than in the female; last three segments of the abdomen black, first four with a middorsal yellow stripe, on each side of which is a wider black one; and outside of the latter, on segments three and four, is an additional narrow black stripe. The three specimens of this sex which I have, present no variations. It looks much like the female and is easily associated with it.

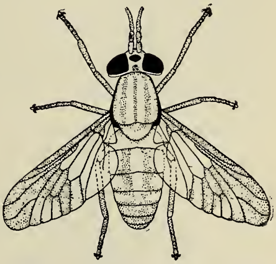

FIG. 16.—*Chrysops univittatus,* female. Enlarged.

The species has been collected in many of the states from Pennsylvania to Louisiana and west at least to Illinois. Taken at Keachie, May 10 and 18, 1906, by J. B. Garrett. In Ohio it is one of the early appearing *Chrysops* and is noticeable on account of its habit of attacking the ears of domesticated animals. Louisiana specimens are a little smaller than those from farther north, but otherwise there does not appear to be any difference in specimens from this State and from Ohio.

CHRYSOPS VITTATUS WEIDEMANN.—Length 8-9 millimeters. Face, palpi and base of antennæ yellow; thorax dorsally with four bright yellow longitudinal stripes with brown intervals separating them; scutellum yellow; hyaline triangle of the wing rather small, occupying the apical part of the first three posterior cells and extending into the first and second submarginal in the region of the branching of the third vein; a hyaline streak in the second submarginal cell usually follows the posterior branch of the third vein toward the margin of the wing, but does not reach this margin.

Female: Frontal callosity yellow; first basal cell of wing brown, second slightly infuscated at base, otherwise hyaline, cross-band very nearly attains the posterior margin; the fourth posterior cell, except narrow apex, fifth posterior, except at base and narrow apex and anal at apex, brown, abdomen dorsally with four longitudinal black stripes; the two inner are pale on the first segment and the two outer on the first and second segments; ventrally yellow, darkened at apex, and on either side with two narrow dark lines abbreviated before.

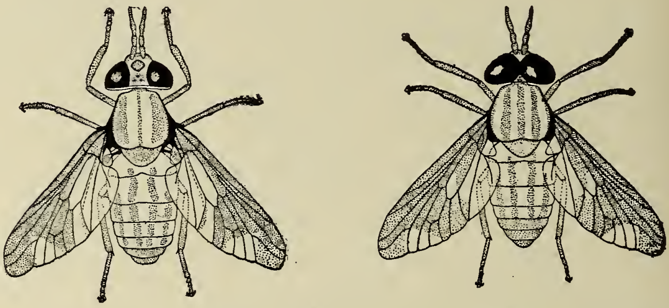

FIG. 17.—**Striped earfly, *Chrysops vittatus*, male and female. Enlarged.**

Male: Like the female, except the second basal cell of the wing has only the apical third hyaline.

Widely distributed over eastern North America as far west as Kansas and Iowa. In Louisiana it has been collected in nearly all sections of the State and at various dates from June 1 to September 10. At Lecompte, in Rapides Parish, the past summer the fly was exceedingly abundant and troublesome August 25, when observations were made in that region. It is rather large in size for a member of its genus, and the females are often seen on horses and cattle with their abdomens filled with blood to their utmost capacity. In such condition they are not able to fly well, and they either drop to some low growing plant that the animal passes, or fly off for a short distance and alight on a leaf or some other object, where they remain until their bounteous meal is digested.

THE GENUS *TABANUS.*

The species of this genus are of variable sizes. Thus some are only about the size of members of the genus *Chrysops,* while others may reach a length of over an inch, with a wing expanse of as much as two inches and a half. The structure is very near the same in the different forms, but some variation is apparent in the shape of the third antennal segment and in the width of the front in the females. In all cases there is an apparent enlargement or process at the base of the third antennal segment above, and the hind tibia never bears spines at its apex. These last two characters always serve to distinguish these insects from those of the genus *Chrysops,* although they are not often needed, for the larger size is generally sufficient for the purpose. Color, considered together with its distribution and arrangement, is of the utmost importance in separating the various species, but there is some variation in this, so it cannot be depended upon entirely in all cases. The difference in size is used with good results in most cases, but it must be remembered that specimens of the same species may have quite a range in this regard, so size, when used entirely alone, is a little risky. From the above statements it is apparent that no one character is sufficient as a means of locating species throughout the genus, but if all these characters are considered not a great deal of trouble will result from an attempt to put specimens in their proper places.

The females of all the species known are thought to be blood-sucking when the opportunity presents, but there seems to be no doubt but that almost any of them may procure their food from plants or from excretions of insects, especially of the order *Hemiptera.* The larger specimens take more blood from an animal at a single meal, but it is doubtful if they cause much more pain in biting than do the smaller ones. The rank of a species in regard to its injuries depends largely upon its abundance, and as some of the medium-sized horseflies are the ones that appear in greatest numbers, they are of the most importance from an economic standpoint. However, when once the adult state is reached economic treatment requires scarcely any attention to species, for all may be put in together and counted as so many horseflies. With the immature stages it is different, for there is often variation in the location of the eggs and the conditions under which the larvæ are found. There is much to find out about the immature stages of many species of horseflies, but what is known is sufficient to prove that the different species are variable in habits, and that it is necessary to consider each species separately, at least until it is proven that certain ones may be grouped together on account of similar life histories.

The genus *Tabanus* has many representatives in all the Southern States where careful collecting has been done, and the fact that twenty-seven species have been taken in Louisiana so far simply proves that it is no exception to the general rule. The diversified topography of the State is favorable to a large variety of species.

KEY TO THE LOUISIANA SPECIES OF THE GENUS *TABANUS*.

1. Whole body, including the wings, black 2
   The wings, at least, not black 4
2. Front of the female unusually broad, callosity transverse .... *striatus*
   Front of the female not unusually broad, callosity not transverse 3
3. Narrow portion of the third antennal segment very long; shining species .... *lugubris*
   Narrow portion of the third antennal segment not very long; not especially a shining species .... wiedemanni
4. Body entirely pale, as if faded .... *mexicanus*
   Body not having a faded appearance 5
5. Abdomen black or dark brown, without stripes or spots 6
   Abdomen not so colored 7
6. Wings smoky, more intense spots on the cross-veins and on the furcation of the third vein .... *benedictus*
   Wings hyaline, with the costal border clear brown .... *americanus*
7. Wings spotted or clouded with black or brown 8
   Wings hyaline except sometimes the costal border infuscated 17
8. Wing spots extensive, giving the wing a variegated appearance .... *venustus*

Wing spots confined to the margins of the veins and furcation of the third vein.......................... 9

9. Eyes distinctly hairy..........................*megerlei*

Eyes not hairy.. 10

10. First posterior cell closed...................*abdominalis*

First posterior cell open 11

11. Abdomen above with a wide middorsal gray stripe..*acutus*

Abdomen not so colored............................ 12

12. Prevailing color of the whole body gray.....*cymatophorus*

Prevailing color of the whole body not gray.......... 13

13. Antennæ entirely black, dark colored species......... 14

Antennae partly or wholly red, lighter species........ 15

14. Three white triangles on the abdomen........*trimaculatus*

Four abdominal triangles and posterior margins of the segments white...............................*molestus*

15. Front tibia brown..................................*fronto*

Front tibia gray on basal half...................... 16

16. Abdominal triangles of the female of moderate size..*exul*

Abdominal triangles of the female large and distinct ....*sulcifrons*

17. Abdomen with a single middorsal row of gray triangles 18

Abdomen not so marked............................. 19

18. Prevailing color of the tibiæ black...............*coffeatus*

Prevailing color of the tibiæ gray............*melanocerus*

19. Abdomen banded, but with no stripes or spots....*annulatus*

Abdomen with stripes or spots, or both.............. 20

20. Abdomen with a middorsal row of unconnected triangles, with a row of rounded spots on each side..*pumilus*

Abdomen with a middorsal stripe or row of connected triangles with a stripe or row of spots on each side.. 21

21. Eyes in life with a single purple band. (The color of the eyes in dry specimens may be revived by moisture obtained by a few hours in a relaxing dish.).... 22

Eyes in life with more than one purple band......... 24

22. Abdomen prevailing dark brown, with a regular middorsal gray stripe and a disconnected row of rounded spots on each side......................*fuscicostatus*

Abdomen with a middorsal gray stripe, with a dark brown stripe on each side, followed by yellowish.... 23

23. Face whitish, thorax gray, hind tibia faintly brownish at tip ....*nigrovittatus*
Face yellowish, thorax grayish yellow, hind tibia distinctly black at tip..............................*costalis*

24. A longitudinal row of unconnected grayish spots on each side of the abdomen above..................... 25
Abdomen not so marked........................... 26

25. Upper angle of the third antennal segment prominent, front narrow, narrowest below...............*fulvulus*
Upper angle of the third antennal segment nearly lacking, front of normal width with sides parallel......*sagax*

26. Abdomen with a middorsal gray stripe with a longitudinal row of connected angular spots on each side...*lineola*
Abdomen with a middorsal gray stripe with a brown stripe on either side and these latter followed by yellowish, either diffuse or in the form of stripes ....*quinquevittatus*

DESCRIPTION OF LOUISIANA SPECIES OF *TABANUS*.

TABANUS ACUTUS BIGOT.—General color, light brown; first two segments of the antenna and the base of the third light brown, apex of the third darker; wings wide, light brown and with a small dark spot at the furcation of the third vein; legs concolorous with the body, apex of each anterior tibia and all the tarsi darker; abdomen light brown, a little darker toward the apex, with a middorsal, wide, gray stripe extending for the whole length.

Female: Length 15-19 millimeters, head rather small, face and front clothed with yellowish pollen, front of normal width, sides parallel, frontal callosity large, shining chestnut in color, inferiorly not quite so wide as the front, narrowed slightly above and with a connecting line extending more than half-way to the vertex, abdomen elongate, conical, gradually narrowed toward the apex.

Male: Length 14-16 millimeters, head rather small, hemispherical; abdomen quite noticeably narrowed to two-thirds of its length, sides nearly parallel from thence to apex.

The species was described from a specimen procured near New Orleans. The past summer several males and females were taken along the Mississippi River below that city and a single female at Cameron, near the Gulf Biologic Station. Several of the specimens were taken from near the rear end of a moving train, one from the rigging of a passenger boat, while two females with their abdomens already filled were observed biting horses.

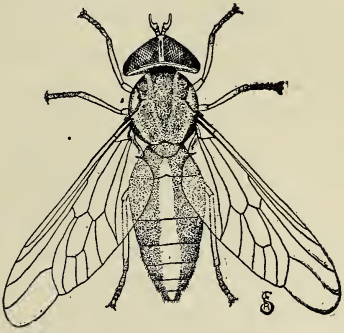

FIG. 18.—*Tabanus acutus*, female. Enlarged.

TABANUS ABDOMINALIS FABRICIUS.—Length about 20 millimeters, although some specimens are larger and some are smaller. Palpi and proboscis dark, almost black; antenna dark at base and apex, basal portion of the third segment red; face and front clothed with yellowish pollen, front rather narrow, frontal callosity rectangular, shining black and with a narrow line above. Thorax striate, wings reddish brown with the margins of the cross-veins and the furcation of the third vein decidedly darker; legs prevailing black in color, but all the tibiæ are reddish at base; in fact, the middle and posterior tibiæ are black only at extreme apex. Abdomen somewhat variable but more reddish than the thorax. In some specimens the abdomen is almost uniformly red, while in others there is a predominance of black or dark brown. In the latter there is a light triangle on the posterior part of the dorsum of each segment, expanding into a posterior border of the same color. Although the two kinds of specimens have a different appearance, there does not seem to be any difference in other regards than the one mentioned, and even here there is a gradation which indicates that they are inseparable.

Very close to *exul* and *sulcifrons*, but the closed first posterior cell serves to distinguish the species from these as well as from some others that are somewhat like it.

Distributed from Illinois to New Jersey, southward to Florida and westward to Kansas. Taken in Louisiana, at Merryville, June 16th, by C. W. Flynn, at Baton Rouge July 6th by E. C. Cotton, and at Newellton August 15th.

Mr. C. W. Flynn observed the following conditions while driving from Singer to Merryville on June 16th: "Whenever a branch or ravine was crossed, the horseflies would simply swarm about the team. The species of *Chrysops* were chiefly of *vittatus, flavidus* and *pikei.* Specimens of each of these were taken, and one or two others were noted but not taken. Of the genus *Tabanus, americanus* was decidedly the most abundant and annoying. This species would dart around the horses once or twice so swiftly that they could hardly be seen and then alight suddenly and begin sucking immediately. Next in abundance was *abdominalis,* several specimens of which were taken. Two specimens of *lugubris* were procured from horses and *mexicanus* was seen but not taken.

TABANUS AMERICANUS FORSTER.—Length 25-30 millimeters. The largest species of horsefly in North America. Body uniformly reddish, thorax and abdomen with gray bloom. Face and front yellowish, frontal callosity shining brown. Antenna with a very prominent basal process, largely reddish in coloration, although the annulate portion is usually somewhat darker. Side of the thorax with hair near the base of the wing. Legs very near in color to the dorsum of the thorax, wing hyaline with the costal cells and stigma brown. The male does not differ from the female except in sexual characteristics.

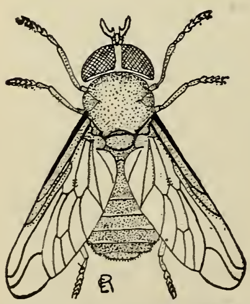

FIG. 19.—American horsefly, *Tabanus americanus,* female. Natural size.

Common over much of southeastern United States, at least as far west as Missouri. In Louisiana it is widely distributed and no locality was visited the past summer where it was not in evidence. I have never seen it so numerous as many of the other species which are smaller in size. Its bites are severe and it is one of the species which is found in the cleared fields as well as in the woods, and in driving along country roads the team is often attacked.

TABANUS ANNULATUS SAY.—Length 12-14 millimeters. This insect has an immature appearance in all cases. Proboscis dark, nearly black, palpi pale and clothed with white hairs; antennæ uniformly pale brownish, third segment with a well developed angle above. Thorax gray without stripes, wings hyaline, front leg with femur, apex of tibia and tarsus nearly black, basal two-thirds of tibia pale, apex of each tarsal segment dark; hind leg colored like the middle, except the femur seems to be a little darker, at least in some specimens.

Female: The front is narrow, and what in other species is called the spindle shaped lines unite to form a very narrow raised line of nearly uniform width reaching nearly to the vertex. Abdomen brown with a gray posterior border to each segment.

Male: Head not much larger than in the other sex, area of enlarged facets distinct and extending nearly back to the occiput above. Thorax and abdomen clothed with a thick coat of long white hair, which almost entirely obscures the ground color of the body. This coating of white hair gives the male a very different appearance from the female, but in other respects the two sexes are much alike. The annulations of the abdomen, from which the insect is named, are not to be seen in this sex. The male of the species was unknown up to this time.

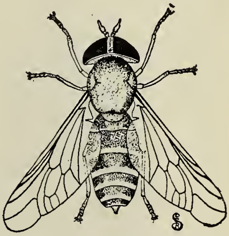

FIG. 20.—*Tabanus annulatus*, female. Enlarged.

The species is known from Missouri, Kentucky, Georgia and Kansas. In Louisiana it is rather common, if one may be allowed to judge from last summer's observations. It was taken often from horses and from the rear of moving trains. The under parts of animals appear to have most attractions for the species, and it flies so quietly that oftentimes it has alighted and commenced sucking before its presence is made known, and often much effort is required on the part of an animal to dislodge it.

Nothing was learned of the habits of the species in its immature stages, but a few things observed perhaps warrant a suggestion. Mr. C. W. Flynn procured a male and a female from a large breeding cage at Keachie on June 7th, under conditions which seem to indicate that the larvæ must live in rotten logs and the like. The only way the specimens could have gotten into the cage is as follows: "The larvæ may have been in the ground beneath the cage or they may have been in decaying logs which were put into the cage on account of some experiments concerning the hibernation of the cotton boll weevil. As the cage mentioned had stood in the same place during the previous year, the first means is improbable, so from what remains it is quite likely that the larvæ were in the logs in question." Again I took a male specimen that was teneral and scarcely able to fly, several rods from water where it was crawling on foliage very close to an old log heap, thus arousing my suspicion that the specimen had emerged in the immediate vicinity. The species was taken in all the localities visited north of the Gulf coast region and was most abundant in woodlands.

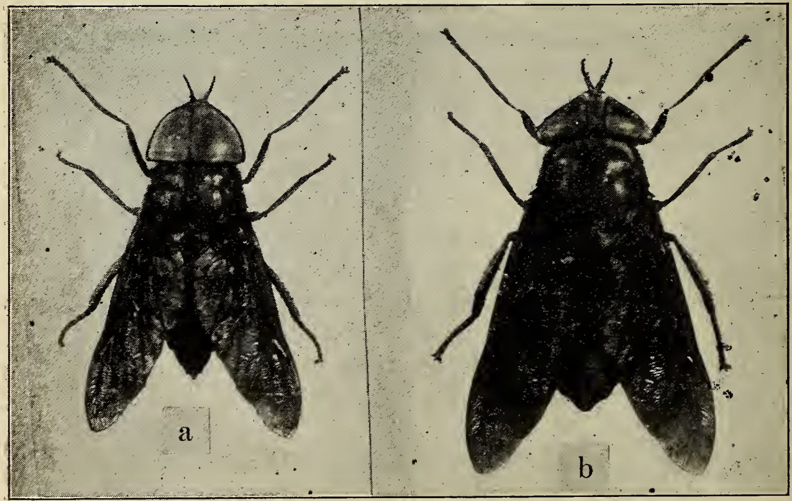

FIG. 21.—Black horsefly, *Tabanus atratus,* male and female. Enlarged. (Author's illustration, Bul. 12, Tech. Ser., Bur. of Ent., U. S. Dept. of Agr.)

TABANUS ATRATUS FABRICIUS.—Length 16-28 millimeters. The male and female of this common species are easily associated, as they differ only in sexual characteristics. The whole insect is uniformly black and the thorax and abdomen in well preserved specimens are thinly covered with whitish dust, which is easily rubbed off when specimens are not properly cared for.

The smaller specimens resemble *wiedemanni* very closely. The wider front, the longer basal process of the third antennal segment, the shape of the frontal callosity, which is square in *wiedemanni* and wider than high in *stiatus,* are distinctive characters. Its much larger size and less shining color distinguish it from *lugubris.*

The black horsefly was observed in every locality in Louisiana visited, and it is indigenous to a large part of eastern North America. Like the American horsefly, it is often seen in the cleared fields and does not appear in enormous numbers, as is the case with *costalis* and its allies.

TABANUS BENEDICTUS WHITNEY.—Length 20-25 millimeters. A large horsefly related to *nigrescens* of the Atlantic coast states, and appearing somewhat like *atratus.* The general color of the whole body dark brown and the abdomen is furnished with a thin coating of gray dust which gives it an appearance like the same part in *atratus.* Wings a little brownish, but nearly hyaline, with darker markings on the margins of the cross-veins and at the furcation of the third vein. Legs nearly black, slightly

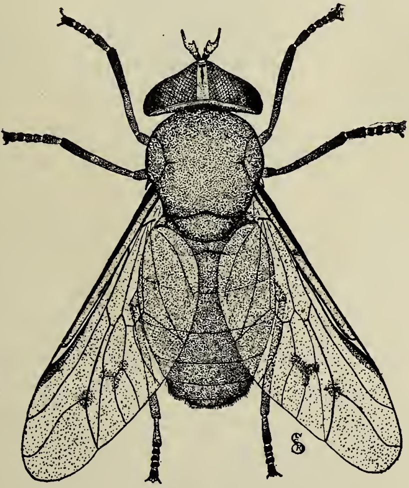
FIG. 22.—Brown horsefly, *Tabanus benedictus*, female. Enlarged.

lighter on the base of each tibia. The two sexes are alike in coloration and easily associated. The first posterior cell of the wing is closed or much narrowed, by which character the species is characterized.

The species has been reported only from Missouri and Louisiana. In the latter state specimens have been taken at Crowley, Montgomery, Frierson, Baton Rouge and Newellton, but so far as my information goes, is not particularly numerous in individuals in any case.

TABANUS COFFEATUS MACQUART.—Length 13 to 14 millimeters. General color black, but with the thorax with white stripes and with middorsal row of white triangles on the abdomen. Front of normal width with the sides nearly parallel, frontal callosity rectangular with a line above, all shining dark brown; face clothed with white hair, palpi slightly darkened, antennæ and proboscis black. Thorax plainly marked with white and black alternating stripes. Wings nearly hyaline, sometimes with a very small dark spot at the furcation of the third vein and with a distinct brown stigma, first posterior cell wide open. Legs black. Abdomen black with white posterior borders, which expand into triangles at the middle, on the segments. The last two segments are usually entirely black. The male of this species was not procured, but is said to resemble the female, although the white markings of the abdomen are reduced.

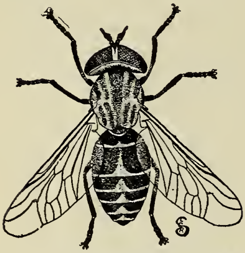

FIG. 23.—*Tabanus coffeatus,* female. Enlarged.

The species is reported from Massachusetts southward, and as far west as Indiana. In Louisiana two specimens were taken from a horse August 25, 1906, at LeCompte, in Rapides Parish. I have never heard of its being abundant enough to become a serious pest, but its habits suggest that it is very persistent in its attacks upon animals, so if abundant would call for more than ordinary attention.

TABANUS COSTALIS WEIDEMANN.—Length 12-14 millimeters. Palpi yellowish, antennæ brownish with the annulate portion darker; thorax, including the scutellum, uniformly grayish yellow pollinose; legs largely black, base of front tibiæ and the middle and hind tibiæ except at apex yellowish; wings hyaline with the costal cells yellowish, veins yellowish; abdomen above alternately striped with black and grayish yellow.

Female: Frontal callosity black, above with a very much narrowed prolongation, the part of which adjacent to the callosity is sometimes obliterated, leaving the upper part as a separate spot.

Male: This sex is much like the female and easily associated with it, but there is a tendency toward obliteration of the distinct markings of the abdomen, the black of the female is replaced by brownish and the stripes may blend so that the whole base of the abdomen is practically one color.

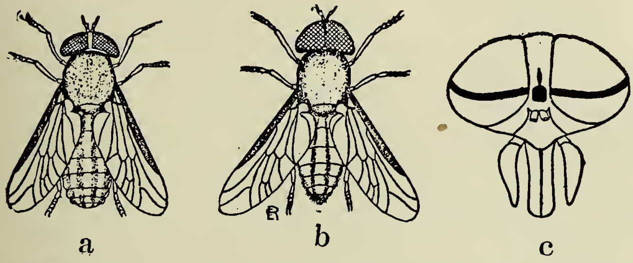

Fig. 24.—Greenhead horsefly, *Tabanus costalis*: *a*, female; *b*, male; *c*, front view of head of female. Enlarged.

Reported for eastern North America in general. In Louisiana taken at Buras and Cameron and at a number of other points, especially along the Gulf coast. Its group comprises the most annoying and injurious species of the family because the various forms become so abundant in individuals in certain localities.

Tabanus cymatophorus Osten Sacken.—Length 20 millimeters. Some specimens smaller. General color gray with dark colored legs and spotted wings. Front gray, frontal callosity and line above shining black, antennæ and palpi dark, third segment of the antennæ reddish at base; eyes bare. Thorax gray with lighter, not plainly marked, stripes; legs black with all the tibiæ light on basal parts; wings hyaline with distinct dark margins to the cross veins and furcation of the third vein; abdomen mostly gray, only the anterior border of each segment dark. The species is distinct, somewhat resembling *reinwardtii,* but the latter has hairy eyes and so far has not been taken in Louisiana.

Known from Illinois, Kentucky and Georgia. Taken near Crowley, Louisiana, in June, 1905. Not known to be abundant in any locality.

TABANUS EXUL OSTEN SACKEN.—Length 18 to 20 millimeters. Much like *abdominalis* described above. The first posterior cell is open, but much narrowed at the apex, front broad, frontal callosity of corresponding width. The gray triangles on the abdominal segments are more distinct than in *abdominalis,* but not so large as in *sulcifrons.* These three species are often mixed in collections, and it is a fact that when specimens from many localities are brought together the task of determination is not an easy one, for there appears to be some variation according to locality. Specimens that appear to be typical are at hand from Frierson, Louisiana, taken in July, 1905.

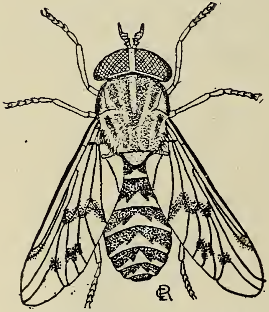

FIG. 25.—Gray horsefly, *Tabanus cymatophorus,* female. Enlarged.

Osten Sacken reported specimens from New Jersey, Pennsylvania, Maryland and the District of Columbia, and it has been identified from a number of localities since.

TABANUS FRONTO OSTEN SACKEN.—Length 16-18 millimeters. General color brown with the posterior border of each abdominal segment lighter, legs and antennæ reddish, and wings brownish, darker on the margins of some of the veins. Front rather wide, frontal callosity wide, rectangular and with the line above shining reddish. Antennæ and palpi mostly reddish, face clothed with dull yellowish pollen. Thorax brown, striped with gray, legs reddish with darker tarsi. Veins of the wings margined with brownish, cross-veins and furcation of the third vein margined with dark brown, almost black, middle part of some of the cells of the wing almost hyaline. Each segment of the abdomen brown, or nearly black in front, with the posterior margin yellowish and expanding into a small triangle at the middle.

Known from the Carolinas, Florida and Texas. Taken in Louisiana in 1905.

TABANUS FULVULUS WIEDEMANN.—Length 15 to 18 millimeters. Front narrow, narrowest before, frontal callosity small, shining brown and not connected with the line above; antennæ reddish with the exception of the annulate portion of the third segment, which is black, basal process of the third segment of the antennæ prominent. Thorax yellowish, unstriped; legs largely reddish, but usually the bases of the femora and the tarsal segments are partially blackish; wings hyaline, costal border dilute yellowish and stigma distinctly brownish yellow. Ground color of the abdomen dark brown, a dorsal stripe, narrow posterior margin of each segment and a row of rounded spots on each side gray.

Known from New Jersey and Kentucky southward in eastern United States. Taken at Baton Rouge, New Roads, Keachie, Crowley and at several other points in Louisiana. Specimens were observed to be plentiful at one or two places visited and it appeared to be characteristic of them to attack the under parts of animals. When they once alighted they were difficult to dislodge and one could easily put the cyanide bottle over them while they were engaged in procuring blood.

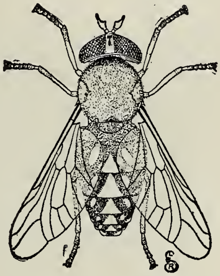

FIG. 26.—*Tabanus fulvulus,* female. Enlarged.

TABANUS FUSCICOSTUS HINE.—General color fuscous; front of normal width, yellowish gray in color, sides nearly parallel, frontal callosity brown, nearly square and with a line, usually unconnected above, antennæ rather long, basal segment slender, third segment with a well defined basal process above and with the annulate portion black or at least dark, palpi white, proboscis black; face, sides and ventral part of the thorax clothed with white pollen and pile; disc of the thorax gray, unstriped; legs reddish in general coloration, all the femora often cinerous on basal part, apical part of each anterior tibia and all the tarsi brownish; wing hyaline with the costal cell dark, fuscous in most specimens; abdomen with a distinct middorsal stripe which has a tendency to increase slightly in width at the posterior border of each segment, and a row of spots on each side. Length of the female 10-15 millimeters.

Type locality Baton Rouge, Louisiana, but specimens are at hand from various parts of that state. From dry specimens the species can easily be placed under *sagax*, for the color of legs and abdomen are right for that, but when the living specimens are studied it is found that the eye is crossed by only a single purple band, which, with the colored costal cell, would denote relationship with *costalis*. The male was not procured.

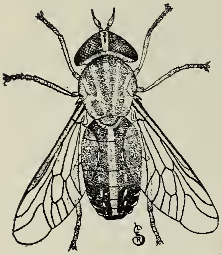

FIG. 27. — *Tabanus fuscicostatus*, female. Enlarged.

Common in wooded areas, and in such places one of the most abundant and persistent species observed in the localities where it was present. It belongs to the *costalis* group, most members of which are of more than ordinary importance from an economic standpoint.

TABANUS LINEOLA FABRICIUS.—Length 12-15 millimeters. Palpi white, antennæ reddish, annulate portion of the third segment darker; thorax brown and gray striped, the latter color not prominent; wings hyaline; legs reddish, apex of the front tibia plainly, apices of middle and hind tibiæ faintly, and all of the tarsi dark brown; abdomen above brown or black with three prominent gray stripes.

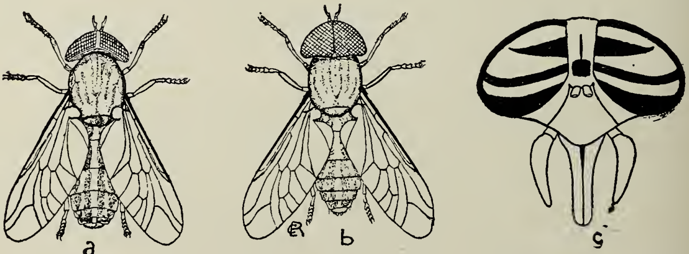

FIG. 28.—Lined horsefly, *Tabanus lineola*: *a*, female; *b*, male; *c*, front of head of female. Enlarged.

The males and females of this species are easily associated. In the latter sex there is sometimes a confusion of colors; the dark is replaced by reddish, but the gray middorsal stripe is always prominent in all well preserved specimens.

Common in eastern North America and known from as far west as Arizona. During the time I spent in Louisiana it was among the first species to be taken in each locality visited. It often appears in large numbers and at such times is to be considered among the worst of its family.

TABANUS LUGUBRIS MACQUART.—Length 12-14 millimeters. Entirely black all over, including the wings. Front wide with a prominent shining black callosity, upper part gray pollinose. Subcallus, region of the antennæ and the face shining black; antennæ located on a slight prominence, the third segment long with a distinct angle above at base. The shining black color of the thorax and abdomen is distinctive.

Known from South Carolina and Florida. Taken at Merryville, Louisiana, June 16, 1906, by C. W. Flynn. Two specimens were collected from horses.

TABANUS MEGIERLEI WIEDEMANN.—Length 18 millimeters. Front of normal width, dark in color, callosity shining black; antenna black with the exception of the base of the third segment, which is red, basal portion of the third segment with a prominent projection above; palpi and proboscis black; eyes distinctly hairy, even in the female. Thorax dark colored, but with narrow gray stripes above; legs black with the exception of the tibiæ, which are largely reddish; wings hyaline with dark dots on the cross-veins and furcation of the third vein, costal cells distinctly brown. Abdomen reddish, with a broad, black stripe in the middle, somewhat narrowed on the second and third segments.

Known from Florida. Taken on the Experiment Station farm at Calhoun, Louisiana, April 7, 1905, by Mr. Wilmon Newell. Collected from a mule.

TABANUS MELANOCERUS WIEDEMANN.—Length 15 to 18 millimeters. Front narrow, callosity elongate and shining black, antennæ black, palpi pale with black hairs; thorax gray with lighter gray stripes above, wings hyaline, prevailing color of the legs black, front tibiæ gray on basal half, other tibiæ reddish except at extreme apex. Abdomen nearly black, although in most specimens there is a reddish tinge, first segment with a white spot beneath the scutellum, second to fifth segments each with a distinct white triangular spot which almost reaches the anterior border, sixth and seventh segments usually black, although the former may have a white triangle of small size. Center of the abdomen reddish except the last two segments, which are largely black. In all the Louisiana specimens taken the first posterior cell is closed and petiolate, but this is not the case in specimens from some other states, although this cell is always distinctly narrowed at the apex.

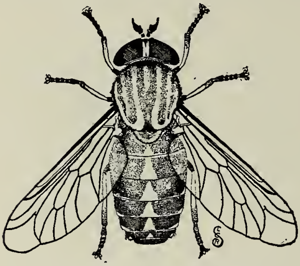

FIG. 29.—*Tabanus melanocerus*, female. Enlarged.

Known from many of the Atlantic States from New Jersey southward. In Louisiana taken at Morgan City, July 17th, and at Lecompte, August 25, 1906. Taken from horses in every case.

TABANUS MEXICANUS LINNAEUS. Length 13-15 millimeters. This specimen cannot be confused with any other in the United States. The whole body is pale yellowish, slightly tinged with greenish. Wings hyaline with the costal border of the same color as the abdomen, legs also concolorous with the body. Front in the female narrow without callosity. Head in the male very large, with an extensive area of enlarged facets.

This peculiar species appears to be common, but as it flies mostly in the evening or early morning and remains in hiding during the day, it is not often seen. It was taken from cows a number of times so late in the evening that it was seen with difficulty. Also taken a few times in dark woods in the daytime.

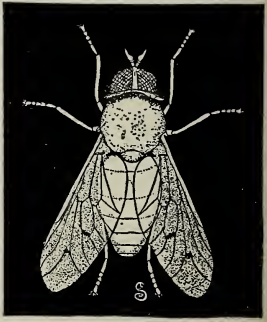

FIG. 30.—*Tabanus mexicanus*, female. Enlarged.

Known from New Jersey southward to Brazil. Taken in Louisiana at New Roads, Baton Rouge and other places in June and July.

TABANUS MOLESTUS SAY.—Length 18-20 millimeters. Front rather wide, callosity and line above shining brown, antennæ usually black, but some of the segments may show a trace of reddish. Ground color of the thorax brown, but with gray stripes above and clothed with white pubescence beneath; legs usually uniform brown in color, but somewhat variable and in some specimens decidedly darker than in others; wings subhyaline, veined brown and with brown margins to the cross-veins and furcation of the third vein, stigma distinctly brown. Ground color of the abdomen brown, darker in some specimens than in others; posterior margin of each segment gray and expanding at the middle to form a spot of triangle. These triangles are large on the third, fourth and fifth segments, but smaller on the other segments; in some specimens almost lacking. Male not differing from the other sex except in sexual characters.

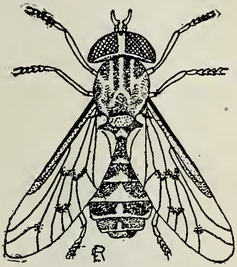

FIG. 31.—*Tabanus molestus,* female. Enlarged.

Known from New Jersey to Kansas and southward. In Louisiana taken in various localities, mostly in the central and northern parts of the State. It has not been taken later than June 20th, although it may occur later.

TABANUS NIGROVITTATUS MACQUART.—General color similar to *costalis;* antenna reddish, first segment slender; third segment with an angle above, annulate portion black, slightly longer than the basal; thorax gray with a faint yellowish tinge; abdomen black in ground color, except each side of the first three segments, which is red, a gray middorsal stripe and on the last three or four segments indications of gray lateral stripes; wings hyaline with the costal cell dilute yellowish; extreme apices of all the femora, basal part of anterior tibia and all except the extreme apices of the other tibiæ yellow, otherwise legs dark brown or black.

Female: Length 9-11 millimeters, front clothed with gray pollen, sides parallel, callosity nearly square, shining and with a line above.

Male: Length 11 millimeters, head small with only a few large facets on the disc of each eye.

Known from several of the Atlantic States. Its occurrence in Louisiana is based on a specimen taken at Buras, Plaquemines

Parish, in July. Although it is to be expected that the species is indigenous to the State, the specimen in question is not typical and further collections are necessary in order to be exact.

Much like *costalis,* but usually smaller. The thorax is less yellowish in coloration and the hind tibia is brown at tip, instead of black as in *costalis.*

TABANUS PUMILUS MACQUART.—Length 8-10 millimeters. First segment of the antennæ and annulate portion of the third black, thorax black with distinct gray stripes, wings hyaline; abdomen above black with narrow gray margins to the segments, a mid-dorsal row of gray triangles, each in connection with the posterior margin of its segment, and on either side of this row of triangles a row of small, nearly round gray spots, none of which touch either margin of the segments.

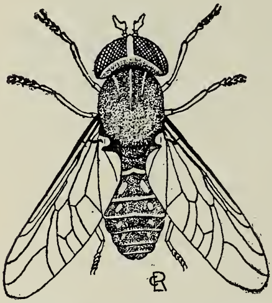

FIG. 32.—Little horsefly, *Tabanus pumilus,* female. Enlarged.

Female: Front distinctly wider above, frontal callosity shining black, nearly square and occupying nearly the whole width of the front. Abdomen sometimes reddish on the sides.

Male: Head large, the division between large and small facets well marked, and there is a striking difference in the size of the facets. The abdomen in some specimens has a suggestion of reddish on the sides.

Known from the Middle and Atlantic States and southward. In Louisiana, taken at Shreveport, Frierson and Logansport.

In appearance very much like *fratellus* of the Northwest, and *sparus* described from New Hampshire. In the latter species the gray spots on the sides of the abdomen above are larger, and on the second and third segments are broadly contiguous with the hind margin. The third antennal segment is noticeably narrowed in *fratellus,* while in *pumilus* it is wide, with a distinct basal process.

In the field this species has habits much like a *Chrysops,* for it persists in its attacks on the collector. Specimens are easily taken with the net at such times. It is often observed annoying horses and cattle.

TABANUS QUINQUEVITTATUS WIEDEMANN. — General color much as in *costalis*. Head large; first segment of the antenna somewhat enlarged and furnished with short black hairs above, third segment rather wide, basal portion red and with a well defined angle above, annulate portion about as long as the basal; thorax yellowish gray; wing hyaline with a small yellow stigma; front legs black with the exception of the basal parts of the tibiæ, which are yellow, apices of femora of the other legs, tibiæ and metatarsi of the middle legs, and tibiæ except apices, and the metatarsi of the posterior legs yellow, other parts brown.

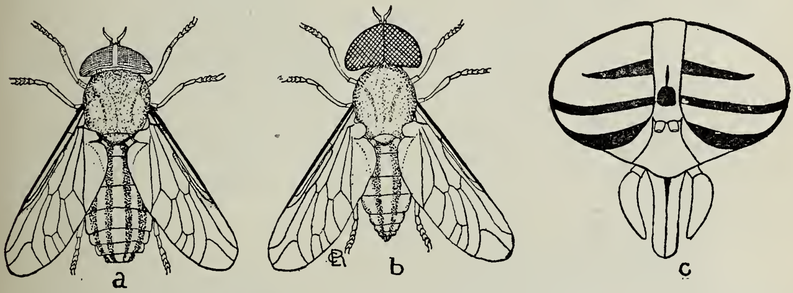

FIG. 33.—*Tabanus quinquevittatus*: *a*, female; *b*, male; *c*, front of head of female. Enlarged.

Female: Length 13-16 millimeters, front of normal width, slightly narrowed below, callosity shining black and nearly square; abdomen above with the margin on each side and three stripes yellow, intervals between the yellow dark brown or black.

Male: Length as in the other sex, head very large, area of enlarged facets extensive, a narrow band of small facets next the occiput above; abdomen somewhat variable; the middorsal stripe well marked and margined with fuscous on either side, remainder usually pale yellowish without well defined markings.

Known from Louisiana, Texas and Mexico. In Louisiana it is common along the Gulf Coast, having been taken at Buras and at Cameron. In appearance much like *costalis* and its relatives. At Cameron it is one of three species which are common and which are much alike in appearance. The following differences were noted:

Tabanus costalis has the stripes on the sides of the abdomen continuous, the front border of the wing is brown and in living specimens the eye is green crossed by a single purple band. *Tabanus lineola* has the markings on the sides of the abdomen in the form of a series of elongate spots which do not form continuous stripes; the wings are hyaline all over and the eyes each have other purple markings besides the single band. *Tabanus 5-vittatus* is the largest of the three. It has the abdomen almost as in *costalis* and the wings as in *lineola*. The color of the eyes in living specimens is of the same pattern as in *lineola*, but the purple markings are not so extended.

TABANUS SAGAX OSTEN SACKEN.—Length 12 to 15 millimeters. Front of normal width, frontal callosity dark, shining; antenna reddish except the annulate portion of the third segment, which is black, basal segment with a very blunt angle; thorax above yellowish pollinose, beneath with gray hairs, wings hyaline with the costal cells yellow; legs mostly red, apex of front tibia and the tarsus black, other tarsi beyond the apex of the metatarsi black. Abdomen brown in ground color, a rather wide middorsal stripe with a row of rounded spots on each side and very narrow posterior margin of each segment gray or at least yellowish. Eyes in life crossed by more than one band.

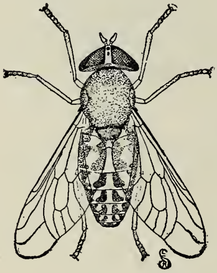

FIG. 34.—*Tabanus sagax*, female. Enlarged.

Known from Illinois, Minnesota, Massachusetts and New Jersey. Taken in Louisiana at Shreveport, June 14, 1905, by Wilmon Newell; Frierson, July 14, and Logansport, Sept. 6, 1905, by J. B. Garrett.

The species is much like *fulvulus*, but the wider front and the lack of a prominent angle at the base of the third antennal segment are distinctive. Separated from *fuscicostatus* in having more than one band on the eye in life. Louisiana specimens are somewhat smaller than specimens from the Northern States.

TABANUS SULCIFRONS MACQUART.—Length 18 to 21 millimeters. Palpi brownish, antenna nearly black with the third segment brownish at base; legs dark, bases of tibiæ darker; wings with a distinct brownish tinge, cross-veins and furcation of the third vein margined with brown.

Female: Front with parallel sides, frontal callosity shining brown, not quite as wide as the front, nearly square and with a linear prolongation above. Segments of the abdomen above with prominent gray hind margins, which expand into large gray triangles in the middle; usually a black mark on the anterior part of each of the second and third segments at the apex of the gray triangle.

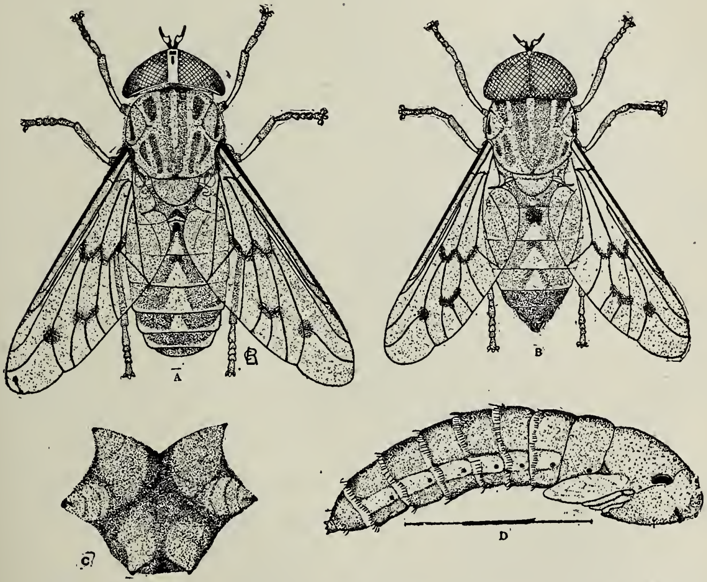

FIG. 35.—Autumn horsefly, *Tabanus sulcifrons*: *A*, female; *B*, male; *C*, end view of the last segment of the pupa; *D*, pupa. Enlarged. (Author's illustration, Bul. 12, Tech. Ser., Bur. of Ent., U. S. Dept. of Agr.)

Male: The division between the large and small facets of the eye prominent; head slightly more convex than in the female, but nearly of the same size, coloration of the whole body the same as in the female.

Known from Pennsylvania, Ohio and Illinois and southward. In Louisiana taken at LeCompte, Logansport, Keachie and Newellton. Specimens taken in August, September and October.

This species is very near *exul* and *abdominalis*. The large, gray, abdominal triangles are characteristic of *sulcifrons*.. In *abdominalis* the first posterior cell is closed, and the front in the female is noticeably narrowed. In *exul* the head of the male is sub-hemispherical and the abdominal triangles are moderate. At times this species is so abundant that it is one of the worst of stock pests.

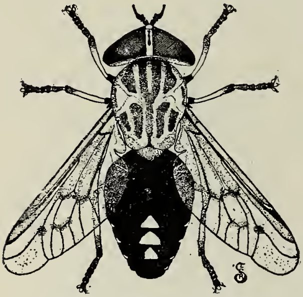
FIG. 36.—*Tabanus trimaculatus*, female. Enlarged.

TABANUS TRIMACULATUS PALISOT DE BEAUVOIS.—Length 16-19 millimeters. Antennæ dark, nearly black, palpi yellowish; thorax dorsally with whitish pollinose stripes and brownish intervals, scutellum uniformly whitish pollinose; legs black except base of all the tibiæ, which are white; wings hyaline, costal cell brown, bifurcation of the third vein, cross veins and sections of veins that have a transverse direction margined with brown; abdomen dorsally black with a large white triangle in connection with the middle of the posterior margin of each of the segments three, four and five; abdomen ventrally white on the sides and a wide black median stripe.

The male and female differ only in sexual characteristics.

Known from the Middle and Southern States west to Kansas and Oklahoma. In Louisiana, taken at LeCompte, August 28, 1906. Two specimens taken from a driving horse.

TABANUS VENUSTUS OSTEN SACKEN.—Length 13-15 millimeters. Antennæ and palpi brownish, thorax with white stripes and brown intervals, scutellum uniformly whitish pollinose; wings variegated with brown and hyaline as follows: Base hyaline as far out as the humeral cross-vein, beyond this a brown band extending from the costa to posterior margin and occupying about half of the anal cell, then follows a shorter band partially confluent with the former and surrounding the cross-veins which close the basal cells, the brown apex of the marginal cell is confluent across the first submarginal with the prominent brown spot at the bifurcation of the third vein, the transverse veins closing the discal cell are broadly margined and a lighter brown space follows the posterior border of the wing to its apex, where it unites with the darker brown in that region.

Female: The posterior margins of the abdominal segments above are gray and expand into prominent triangles in the middle of segments two, three and four. In the middle of the venter is a wide brown stripe bordered on each side by lighter.

Male: This sex is like the other except the dorsal markings of the abdominal segments are extended laterally and give the appearance of wide posterior margins.

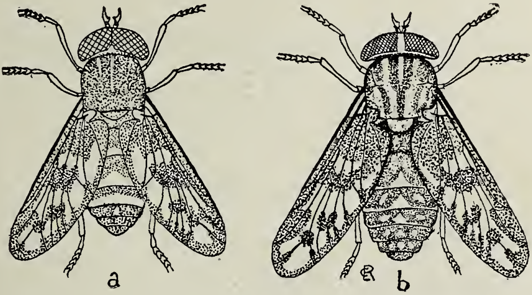

FIG. 37.—*Tabanus venustus*: *a*, male; *b*, female. Enlarged.

Known from Texas, Kansas, Oklahoma and Ohio. In Louisiana, taken at Logansport, LeCompte, Crowley and at several other places.

TABANUS WIEDEMANN OSTEN SACKEN.—Length 20 millimeters. Black all over, including the wings and legs, and in appearance much like small specimens of the black horsefly, *T. atratus*. Separated from that species by the front of the female, which is much narrower. The frontal callosity is elongate and not transverse, as in *atratus*. The species is larger than *lugubris* and not so shining. The wings are not so dark toward the apex as at the base, and there is a larger spot at the furcation of the third vein.

Known from Kentucky, Georgia, Florida and North Carolina. In Louisiana, taken at Keachie, June 14, 1906, by J. B. Garrett.

Louisiana Bulletin No. 94. July, 1907.

Agricultural Experiment Station

OF THE

Louisiana State University
and A. and M. College,

BATON ROUGE.

With the Cooperation of the Louisiana State Board of Health.

The Effects on the Human System of Louisiana Manufactured Syrups and Molasses.

BY

R. E. BLOUIN, Dr. P. E. ARCHINARD and J. A. HALL, Jr.

BATON ROUGE
The State, Official Journal State of Louisiana
1907

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AUDUBON PARK, NEW ORLEANS, LA., July 1, 1907

Professor W. R. DODSON, *Director*,

State Experiment Stations, Baton Rouge, La.:

Sir—I have the honor to herewith transmit the results of experimental work in cooperation with the Louisiana State Board of Health on the effects on the human system of Louisiana manufactured syrups and molasses.

In the selection of the subjects the officials of the Parish Prison, Sheriff M. J. Long, Captain Richard Meredith, Dr. J. A. O'Hara, and Clerk Morris Dreifus, extended every courtesy.

The officials of the House of Detention, Commissioner Alex Pujol, Superintendent Maurice Picheloupe, Assistant Superintendent Robert J. Pollock, Clerk Horace Davezac, and Matron Mrs. James Calder, allowed the use of all the facilities connected therewith, and gave much valuable assistance.

To Deputy Sheriffs J. H. Doherty, Henry Mohr, Clarence Williams and Edward Cain, who were always careful to carry out in detail all instructions, is due the credit for the excellent order which the subjects maintained throughout the experiments.

Drs. J. J. Archinard and E. O. Trahan, who assisted Dr. P. E. Archinard in the physical examinations, blood counts and general medical supervision, did a large amount of highly appreciated work.

Dr. F. Zerban and Mr. H. P. Agee, of the Experiment Station corps, made all the analyses of the syrups and molasses, as well as doing much research work in connection with the experiments.

The syrups and molasses used were those furnished by the New Orleans Coffee Company, who allowed choice of the several brands which they had on hand. Mr. J. W. Hearn, president of the company, made affidavit that these syrups and molasses were in the original packages coming from the plantations of "Albemarle," "St. James" and "Belle Grove."

To all of these I wish to offer my sincere thanks and to assure them that their services are appreciated.

Respectfully submitted,

R. E. BLOUIN,

Assistant Director.

The Effect on the Human System of Louisiana Manufactured Syrups and Molasses.

Both syrups and molasses have been manufactured for over a hundred years, and for that length of time have been used as articles of food. In the early days of the industry these products were regarded as delicacies, but as their production became greater they have assumed the position of staple food products, not only for man, but for the domestic animals. With the invention of new machinery and with the introduction of chemical methods the processes of manufacture have changed, with the result that the quality of syrups, sugars and molasses has been improved and the quantity increased.

From years of observation and experience it was believed that the effects, on both man and beast, of this class of food, even when used in large quantities, were beneficial. Only of late the question of the evil effects of sulphur as sulphites has arisen.

Mr. D. D. Colcock, secretary of the Louisiana Sugar and Rice Exchange, who has for years championed the cause of the sugar industry in Louisiana, first proposed the scientific investigation of the effects on the human system of feeding syrups and molasses containing sulphur as sulphites.

The object of this experiment was to carefully determine the effects of these syrups and molasses when fed in normal quantites in connection with normal diet.

With the idea of formulating definite plans for the work, a conference was held between Mr. Henry McCall, president of the Louisiana Sugar Planters' Association, and Mr. R. E. Blouin, Assistant Director of the Louisiana Sugar Experiment Station. At this conference it was decided to invite the aid and cooperation of the Board of Health of the State of Louisiana, which board is entrusted with the enforcement of the State pure food laws.

Dr. C. H. Irion, President of the Board of Health, after having been consulted, offered to have these experiments conducted under the auspices of the board, and appointed Dr. P. E. Archinard as the representative of the board in charge of the medical and bacteriological investigations. Mr. R. E. Blouin was appointed in general charge of the feeding and chemical investigations.

The United States Department of Agriculture was also invited to cooperate in this work, but due to pressure of other work, it was impossible to send a representative to New Orleans.

The expenses of these experiments, exclusive of the salaries of the attaches of the Sugar Experiment Station, were met by the Louisiana Sugar Planters' Association, and the Louisiana Sugar and Rice Exchange. The members of these two organizations showed keen interest in these experiments and rendered much valuable assistance and encouragement by their frequent visits and observations. This is especially true of Messrs. McCall and Colcock, and of Mr. J. C. Murphy, President of the Sugar Exchange, and of Mr. Reginald Dykers, Secretary of the planters' association.

SELECTION OF SUBJECTS.

It was decided to select as subjects for feeding twelve negroes from among those having short sentences in the Parish Prison. This selection was for three reasons:

1. The well-known fondness of such persons for this class of food;
2. Such subjects' entire ignorance of sulphites and their supposed effects on the human system;
3. The absolute control under which the subjects could be placed.

The methods of administering the syrups and molasses, and the kinds of syrups to be used, were explained to the prospective subjects; then volunteers were asked for. Willing subjects were in abundance and from these were selected the average types, who then underwent the necessary physical examination before being finally selected. It is to be understood that in choosing these subjects no attempt was made to obtain athletic or robust specimens, but simply to get those whose physical condition was normal.

Table I gives a brief description of the subjects selected.

TABLE I.—Description of Subjects.

Number	Color	Home	Occupation	Charge	Length of Sentence	Age	Height	Weight in pounds	Chest		Girth of Abdomen	Deformity
									*Insp.	†Exp.		
									In.	In.	In.	
1	Black	Buras, La.	Steamboat Roustabout	P. Larceny	6 mos.	28	5 ft. 11 in.	159	42	36	33	None
2	"	Jonesville, La.	" "	Dang. & Susp.	29 days	44	5 ft. 5½ in.	153	43	37	36	"
3	"	St. Bernard Ph.	Porter	P. Larceny	6 mos.	19	5 ft. 7½ in.	124	35	31	29½	"
4	Mulatto	New Orleans, La.	Carpenter's Helper	P. Larceny	4 mos.	19	5 ft. 10 in.	130	38	33	32	"
5	Black	Natchez, Miss.	Lonshoreman	P. Larceny	60 days	26	6 ft. 2 in.	203	46	40	40	"
6	"	St. Louis, Mo.	Cook	Dang. & Susp.	29 days	24	6 ft. 5 in.	183	36	34	37½	"
7	Mulatto	Providence, R. I.	Cook	Dist. Peace	30 days	40	5 ft. 5 in.	149	42	39½	40	"
8	"	New Orleans, La.	Helper in Garage	D. S. & P. L.	4 mos.	24	5 ft. 7½ in.	141	37	32	34	"
9	Black	Houma, La.	Plantation Laborer	P. Larceny	6 mos.	22	5 ft. 6 in.	126½	41	37	35	"
10	"	Tennille, Ga.	Fireman	D. S. & C. C. W.	90 days	21	5 ft. 5 in.	128	37	33	31	"
11	"	New Orleans, La.	Ditcher	Assault int. kill	9 mos.	25	5 ft. 8 in.	140	37	32	31	"
12	"	New Orleans, La.	Driver	P. Larceny	60 days	19	5 ft. 4½ in.	129	37	33	34	"

* Insp. stands for Inspiration.
† Exp, stands for Expiration.

It is seen from the preceding table that all the offenses of the subjects were of a minor character, and are such as those for which the majority of negroes have at one time or another been punished.

QUARTERS OCCUPIED BY SUBJECTS.

Immediately after their selection in the Parish Prison, the subjects were transferred to the House of Detention, where they were quartered during the entire experiment. This particular place was selected so that the subjects might be kept together and at the same time be separated from the rest of the prisoners.

The room occupied was on the second floor and was fifty feet long by fifteen feet wide. The west side of the room was fitted with six large windows; the opposite side, opening into one of the main corridors, was made entirely of iron bars. One end was a solid brick wall, while the other gave access to a lavatory fitted with the usual sanitary appliances. On the opposite side of the corridor was a room similar to the one occupied by the subjects.

The bunks were made of iron piping with upper and lower tiers, and so arranged that the bedding could be rolled up and strapped to the wall, thus leaving more available space during the day.

Each subject was assigned his own bunk and given the requisite bedding which, on stated days, he was required to wash.

Each morning the cement floor, frames of the bunks, etc., were scoured, and the whole room thoroughly cleaned.

Sunlight and ventilation were ample, and the weather was such that at no time was it necessary to use the steam radiators with which the building is equipped.

The building is regularly disinfected with a volatile spray in order to minimize the transmission of any contagious disease which might be brought in, and further precautions along this line were deemed unnecessary.

The quarters occupied, then, while not elaborate, were of sufficient size, well lighted and ventilated, and at all times scrupulously clean.

WORK AND EXERCISE REQUIRED.

As an examination of Table I will show, the subjects were accustomed to physical labor, so it was deemed wise to require of each an amount of work commensurate with that usually done.

After rising at 5 a. m., the squad was required to scour that wing of the building of which their quarters were a part. Some two to two and a half hours were consumed at this work.

Breakfast was eaten at 8 o'clock.

From 9 until 12 the squad was in the yard, during which time they were required to do such work as piling lumber, crushing brick, and washing their clothes and bedding.

From 12 to 1 the squad was allowed to rest, and at 1 o'clock dinner was on the table. At 2:30 on four days of the week three of the subjects were taken to physician's laboratory, where they underwent the medical examinations later tabulated.

The remaining nine subjects were employed at odd jobs around the place from 2:30 to 4. On the two week days when no one was taken away for examination, the squad was employed from 2:30 to 4 on the brick pile.

At 4 o'clock they were allowed to rest half an hour, when their temperatures were taken, after which each one had a cold shower bath.

On Sundays after breakfast the squad was allowed to attend the religious services held in the building. After mass was said they were given the freedom of the yard and generally employed the time in playing baseball or some other athletic game.

On Sunday afternoons they were again allowed to go into the yard and to remain until 4 o'clock.

At 5 o'clock supper was eaten.

After supper they were returned to their quarters and allowed to dispose of their time to suit themselves. Daily papers, stationery and playing cards were at their disposal, so that the time did not pass slowly.

The hour for retiring was 9 p. m., though they were given the privilege of retiring earlier.

CONTROL.

The squad was, of course, subject to the general regulations of the prison, though in several important particulars these rules were modified to suit the special case. Four deputy sheriffs were employed to have constant surveillance of the squad, two sheriffs being on duty during the day and two at night.

A representative of the Sugar Experiment Station was present at every meal, and was charged with the general care of the subjects. He was also present the greater part of the day and paid occasional visits at night.

It was attempted to make the daily routine conform as closely as possible to the ordinary conditions of living met in the class of subjects under observation, with such additional sanitary and hygienic measures as seemed expedient.

Every liberty possible was given the subjects, yet no opportunity to abuse these liberties was allowed. It was necessary to observe certain rules of discipline, infractions of which were punishable by confinement in the "dungeon." This dungeon was simply an isolated dark room where the culprit was kept in solitary confinement for a few hours. In those instances where the term of confinement included a meal-hour the subject was allowed to come to the table and eat with his fellows.

Instances where punishment was necessary were rare and every case was caused by disagreement between subjects who became engaged in arguments.

Friends of the subjects were allowed to visit them, but were not permitted to bring articles of food or drink. The control of the subjects was such, then, that it was impossible for any of them to vary from the prescribed course. These limitations, however, were not galling and that their treatment was conducive to contentment was evidenced by the fact that three subjects whose prison terms expired before the termination of the experiment voluntarily remained until its close.

PSYCHIC INFLUENCE.

The prospective subjects before being selected were simply told that it was desired to test syrups and molasses. The method of administering the syrups and molasses was carefully explained, as well as the fact that these syrups and molasses were those to which they had long been accustomed.

When the syrup feeding period began the squad as a unit attacked the syrups and molasses with a faith born of experience and continued eating these articles in surprisingly large quantities and with great regularity during the entire three weeks. No subject anticipated harmful results, none thought himself a martyr to the cause of science, but rather regarded himself as fortunate. There was no tendency to mental depression and consequent induced physical collapse by constantly recurring thoughts of poison. Not only was there no nausea induced by the food, but, on the contrary, the palatability of these products was such as to create a keen appetite and more than one subject requested a continuance of molasses after it had been stricken from the bill of fare.

There was no feeling of a duty in eating the syrup and molasses, as each subject thoroughly understood that he was to eat his only as his appetite demanded.

Even at the risk of repetition, it cannot be too strongly emphasized that the idea of poison, drugs, preservatives and the like was foreign to the conditions of this experiment, and hence could exert no influence on the subject's state of mind.

It is also to be again noted that the prison surroundings were not such as to create dissatisfaction, and no trouble whatever was experienced in the management of any one of the squad.

DIET.

It was attempted to give the subjects clean, wholesome food of the same general character as that to which they had been accustomed, and to vary the bill of fare from day to day.

A separate dining room was secured and a special cook employed. The food was selected with the care necessary to insure its purity and freshness, and was prepared and cooked under the personal direction of the Sugar Experiment Station's representative. No canned goods were employed, all the meats, vegetables, etc., being those of the season and as fresh as could be procured. Of the food placed on the table each subject was allowed to eat as he chose, there being no prescribed amounts of any article to be consumed, nor was any one required to eat all the dishes placed before him. It is safe, then, to say that no artificial conditions were created, but that the food consumed was that which would have been eaten normally. All detrimental and unnatural factors that could be foreseen were eliminated so that should harm result it could be laid directly to the sulphites in the syrup and molasses.

The twelve subjects were divided into three squads of four each, and each squad was fed on one kind of syrup or molasses during Periods II, III and IV.

Squad I, consisting of subjects 1, 2, 3 and 4, were fed during Periods II, III and IV on genuine cane syrup. The contents of sulphur as sulphites in this syrup was 405 milligrams per kilogram, or four one-hundredths of one per cent.

Squad II (Nos. 5, 6, 7, 8) were fed during the same periods on genuine open kettle molasses. At the beginning of and during Period II this molasses contained 161 milligrams per kilogram of sulphur as sulphites. At the end of Period II sodium sulphite was added to this molasses in quantity sufficient to raise the content of sulphur as sulphites to 502 milligrams per kilo, and this was fed during Periods III and IV.

Squad III (Nos. 9, 10, 11, 12) were fed during Periods II, III and IV on first molasses from the vacuum process. This molasses contained 928 milligrams per kilo of sulphur as sulphites, and, as an examination of its more complete analysis will show, was of approximately the same composition as that of a second molasses produced in an average year.

Each subject was provided with a glass stoppered syrup pitcher, which was put at his place at the table at each meal during the three weeks designated as Periods II, III and IV. The amounts of syrup and molasses eaten were determined by weighing the pitchers before and after each meal.

The bill of fare for every meal during the experiment is given in Table II:

TABLE II.

BILL OF FARE, EXCLUSIVE OF SYRUPS, ETC.

PERIOD I.

April 25—*Breakfast*, stewed beef, bread, butter, tea. *Dinner*, soup, chicken, beans, butter. *Supper*, bread, butter, tea.

April 26—*Breakfast*, veal stew, potatoes, grits, bread, butter, tea. *Dinner*, soup, roast beef, boiled potatoes, boiled cabbage, bread, butter. *Supper*, bread, butter, tea.

April 27—*Breakfast*, stewed meat, fried potatoes, grits, coffee, bread, butter. *Dinner*, soup, pork chops, mashed potatoes, beans, bread, butter. *Supper*, bread, butter, tea.

April 28—*Breakfast*, bacon, eggs, grits, bread, butter, coffee. *Dinner*, soup, roast beef, boiled cabbage, beans, bread, butter. *Supper*, bread, butter, tea.

April 29—*Breakfast*, pork chops, grits, bread, butter, coffee. *Dinner*, soup, broiled steak, mustard greens, corn bread, sweet potatoes, butter. *Supper*, bread, butter, tea.

April 30—*Breakfast*, fried bacon, grits, eggs, bread, butter, coffee. *Dinner*, soup, chicken, rice, potatoes, bread, butter. *Supper*, bread, butter, tea.

May 1—*Breakfast*, ham, fried potatoes, bread, butter, coffee. *Dinner*, soup, roast beef, rice, sweet potatoes, corn bread, butter. *Supper*, bread, butter, tea.

PERIOD II.

May 2—*Breakfast*, stewed beef, fried potatoes, batter cakes, butter, coffee. *Dinner*, soup, steak, mashed potatoes, beans, biscuit, butter. *Supper*, batter cakes, butter, tea.

May 3—*Breakfast*, bacon, eggs, corn cakes, butter, coffee. *Dinner*, soup, stewed meat, mustard greens, corn bread, boiled potatoes, butter. *Supper*, bread, butter, tea.

May 4—*Breakfast*, stewed meat, batter cakes, bread, butter, coffee. *Dinner*, soup, roast beef, boiled potatoes, beans, biscuit, butter. *Supper*, corn bread, butter, tea.

May 5—*Breakfast*, ham, pancakes, bread, butter, coffee. *Dinner*, soup, salt meat, cabbage, bread, butter. *Supper*, biscuit, butter, tea.

May 6—*Breakfast*, pork chops, batter cakes, butter, coffee. *Dinner*, soup, chicken, rice, corn bread, butter. *Supper*, bread, butter, tea.

May 7—*Breakfast*, hash, biscuit, butter, coffee. *Dinner*, soup, boiled beef, cabbage, bread, butter. *Supper*, batter cakes, butter, tea.

May 8—*Breakfast*, meat stew, pancakes, butter, coffee. *Dinner*, soup, roast beef, mashed potatoes, bread, butter. *Supper*, corn cakes, butter, tea.

PERIOD III.

May 9—*Breakfast*, bacon, corn bread, butter, coffee. *Dinner*, soup, stewed beef, corn bread, boiled potatoes, butter. *Supper*, batter cakes, tea, butter.

May 10—*Breakfast*, meat stew, batter cakes, bread, butter, coffee. *Dinner*, soup, roast beef, beans, biscuit, butter. *Supper*, corn bread, batter cakes, tea, butter.

May 11—*Breakfast*, ham, batter cakes, bread, butter, coffee. *Dinner*, soup, fried fish, rice, bread, butter. *Supper*, biscuit, butter, tea.

May 12—*Breakfast*, pork chops, batter cakes, bread, butter, coffee. *Dinner*, soup, chicken, rice, corn bread, butter. *Supper*, batter cakes, butter, tea.

May 13—*Breakfast*, hash, biscuit, butter, coffee. *Dinner*, soup, stewed beef, cabbage, bread, butter. *Supper*, batter cakes, tea, butter.

May 14—*Breakfast*, bacon, batter cakes, butter, coffee. *Dinner*, soup, meat stew, mustard greens, corn bread, butter. *Supper*, bread, biscuit, butter, tea.

May 15—*Breakfast*, batter cakes, bread, butter, coffee. *Dinner*, roast beef, mashed potatoes, beans, corn bread, butter. *Supper*, biscuit, bread, butter, tea.

PERIOD IV.

May 16—*Breakfast*, meat stew, batter cakes, bread, butter, coffee. *Dinner*, steak, fried potatoes, cabbage, corn bread, butter. *Supper*, biscuit, bread, butter, tea.

May 17—*Breakfast*, bacon, eggs, biscuit, butter, coffee. *Dinner*, roast pork, mashed potatoes, rice, bread, butter. *Supper*, batter cakes, bread, butter, tea.

May 18—*Breakfast*, bread, biscuit, butter, coffee. *Dinner*, soup, roast beef, beans, corn bread, butter. *Supper*, batter cakes, bread, butter, tea.

May 19—*Breakfast*, pork chops, biscuit, butter, coffee. *Dinner*, soup, chicken, cabbage, boiled potatoes, bread, butter. *Supper*, batter cakes, bread, butter, tea.

May 20—*Breakfast*, fried liver, biscuit, grits, butter, coffee. *Dinner*, roast pork, rice, mashed potatoes, corn bread, butter. *Supper*, batter cakes, bread, butter, tea.

May 21—*Breakfast*, batter cakes, bread, butter, coffee. *Dinner*, soup, roast pork, mashed potatoes, mustard greens, corn bread, butter. *Supper*, biscuit, bread, butter, tea.

May 22—*Breakfast*, batter cakes, bread, butter, coffee. *Dinner*, soup, meat stew, cabbage, beans, corn bread, butter. *Supper*, biscuit, bread, butter, tea.

PERIOD V.

May 23—*Breakfast*, bacon, eggs, grits, bread, butter, coffee. *Dinner*, soup, roast beef, mashed potatoes, rice, corn bread, butter. *Supper*, bread, biscuit, butter, tea.

May 24—*Breakfast*, pork chops, fried potatoes, bread, butter, coffee. *Dinner*, roast pork, boiled potatoes, cabbage, bread, butter. *Supper*, bread, butter, tea.

May 25—*Breakfast*, liver, fried potatoes, bread, butter, coffee. *Dinner*, soup, steak, rice, sweet potatoes, bread, butter. *Supper*, corn bread, bread, butter, tea.

May 26—*Breakfast*, bacon, fried potatoes, biscuit, bread, butter, coffee. *Dinner*, soup, chicken, rice, beans, bread, butter. *Supper*, biscuit, bread, butter, tea.

May 27—*Breakfast*, bacon, batter cakes, bread, butter, coffee. *Dinner*, soup, roast beef, cabbage, mashed potatoes, corn bread, butter. *Supper*, biscuit, bread, butter, tea.

May 28—*Breakfast*, eggs, grits, biscuit, butter, coffee. *Dinner*, soup, roast pork, rice, cabbage, bread, butter. *Supper*, corn bread, bread, butter, tea.

May 29—*Breakfast*, pork chops, grits, biscuit, butter, coffee. *Dinner*, roast beef, cabbage, rice, corn bread, butter.

Table III gives the amounts of syrup and molasses consumed at each meal, totals for each day, totals for each weekly period, totals consumed at each of the three meals, totals consumed by each subject, and each subject's meal average and daily average:

TABLE III.—MOLASSES

	2	3	4	5	6	7	8	Period Total	9	10	11
No. 1. Breakfast	74	60	93	80	62	63	80	512	100	60	......
Dinner	53	67	97	75	78	93	135	598	90	35	......
Supper	91	85	100	90	50	88	107	611	90	......	127
Total,	218	212	290	245	190	244	322	1721	280	95	127
2. Breakfast	118	55	45	103	75	68	80	544	70	50	90
Dinner	102	45	92	23	70	137	85	554	68	40	85
Supper	35	88	110	42	70	55	105	505	115	......	137
Total,	255	188	247	168	215	260	275	1603	253	90	312
3. Breakfast	135	88	66	119	131	86	110	735	175	95	......
Dinner	126	71	80	109	130	135	175	526	188	95	......
Supper	80	118	106	126	90	125	140	785	190	......	38
Total,	341	277	252	354	351	346	425	2346	553	190	38
4. Breakfast	149	135	135	110	125	125	175	954	225	115	......
Dinner	102	128	126	......	133	130	195	814	......	35	70
Supper	142	130	174	124	132	183	185	1070	220	......	147
Total,	393	393	435	234	390	438	555	2838	445	150	217
5. Breakfast	113	29	......	39	115	58	35	389	185	90	140
Dinner	106	90	18	15	28	65	117	439	78	45	35
Supper	106	109	38	61	108	100	......	522	40	......	200
Total,	325	228	56	115	251	223	152	1350	303	135	375
6. Breakfast	141	......	109	107	105	119	140	721	212	175	......
Dinner	45	......	105	......	......	......	89	239	137	173	......
Supper	119	135	110	111	130	116	160	881	140	......	217
Total,	305	135	324	218	235	235	389	1841	489	348	217
7. Breakfast	50	49	......	33	42	90	65	329	80	135	......
Dinner	30	44	14	7	15	18	33	161	42	105	50
Supper	87	73	52	47	87	70	113	529	120	......	160
Total,	167	166	66	87	144	178	211	1019	242	240	210
8. Breakfast	85	21	91	67	95	127	77	563	33	165	......
Dinner	73	70	72	23	50	75	142	505	68	130	......
Supper	25	97	107	110	105	150	85	679	147	......	156
Total,	183	188	270	200	250	352	304	1747	248	295	156
9. Breakfast	108	115	111	123	112	125	170	864	129	195	200
Dinner	37	125	98	......	105	115	135	615	175	90	75
Supper	101	113	110	115	118	147	150	854	185	30	230
Total,	246	353	319	238	335	387	455	2233	489	315	505
10. Breakfast	60	......	40	59	129	67	72	427	80	95	......
Dinner	63	13	26	28	17	45	50	242	138	45	......
Supper	79	34	54	45	48	110	55	425	97	......	76
Total,	202	47	120	132	194	222	177	1094	315	140	76
11. Breakfast	129	......	97	96	89	33	25	469	......	......	55
Dinner	51	26	66	......	......	110	117	370	......	......	150
Supper	45	102	104	90	110	......	70	572	125	......	93
Total,	225	128	267	186	199	143	212	1360	125	......	298
12. Breakfast	62	......	57	32	95	40	32	318	40	25	90
Dinner	36	......	62	25	42	28	62	255	......	10	130
Supper	59	36	51	85	90	73	143	537	95	65	76
Total,	157	36	170	142	227	141	237	1110	135	100	296

CONSUMED, IN GRAMS.

12	13	14	15	Period Total	16	17	18	19	20	21	22	Period Total	Grand Total	Ave
85	78	35	115	473	50	50	45	35	50	110	50	390	1375	65
113	48	50	55	391	50	50	75	35	25	35	45	315	1304	62
140	150	97	110	712	120	75	95	100	105	70	105	670	1993	95
338	276	180	280	1576	220	175	215	170	180	215	200	1375	4672	222
75	62	70	95	512	88	100	35	50	85	105	100	563	1619	77
135	73	35	110	546	63	130	90	45	65	35	40	468	1568	75
32	65	80	115	544	117	120	85	85	105	115	105	732	1781	85
242	200	185	320	1602	268	350	210	180	255	255	245	1763	4968	237
110	107	80	115	682	95	55	75	55	115	90	75	560	1977	94
55	90	55	10	493	50	45	....	35	....	....	40	170	1489	71
105	175	95	165	768	110	145	115	....	80	35	90	575	2128	101
270	372	230	290	1943	255	245	190	90	195	125	205	1305	5594	266
88	212	85	103	828	120	115	60	100	55	275	....	725	2507	119
134	127	270	150	786	65	260	75	45	210	270	....	925	2525	120
114	185	150	120	936	240	240	265	220	305	280	265	1815	3821	182
336	524	505	373	2550	435	615	400	365	570	825	265	3465	8853	421
125	68	70	....	678	80	....	35	150	....	165	....	430	1497	71
36	....	70	185	449	....	50	95	55	145	....	....	345	1233	59
149	140	....	80	609	100	....	120	85	115	25	15	460	1591	76
310	208	140	265	1736	180	50	250	290	260	190	15	1235	4321	206
135	188	85	155	950	115	133	80	135	100	90	80	733	2404	115
....	....	95	50	455	....	130	45	....	75	....	....	250	944	45
185	110	135	135	922	155	95	85	140	135	130	70	810	2613	124
320	298	315	340	2327	270	358	210	275	310	220	150	1793	5961	234
72	85	25	60	457	130	100	60	80	....	....	50	420	1206	57
70	....	20	....	287	....	25	....	....	....	....	40	65	513	24
108	75	95	115	673	85	60	160	60	115	80	55	615	1817	87
250	160	140	175	1417	215	185	220	140	115	80	145	1100	3536	168
151	168	45	90	652	35	100	65	65	85	235	25	630	1845	88
60	70	35	30	393	....	....	....	....	....	....	45	45	943	45
75	85	170	85	718	95	80	75	90	155	285	35	815	2212	105
286	323	250	205	1763	130	180	140	155	240	620	105	1490	5000	238
31	21	65	25	666	143	30	....	35	....	260	275	743	2273	108
....	....	80	....	420	....	....	....	....	....	260	220	480	1515	72
136	60	....	65	706	55	255	245	75	265	265	265	1425	2985	142
167	81	145	90	1792	198	285	245	110	265	785	780	2648	6773	322
70	50	75	....	370	70	20	40	45	20	35	....	230	1027	49
33	....	....	....	216	....	30	....	....	....	....	....	30	488	23
....	55	....	55	283	60	55	70	20	65	....	30	300	1008	48
103	105	75	55	869	130	105	110	65	85	35	30	560	2523	120
87	29	70	125	366	175	85	55	85	....	105	80	585	1420	67
....	....	....	....	150	....	....	....	....	....	....	....	....	520	25
....	70	70	65	423	110	135	35	75	175	95	25	650	1594	76
87	99	140	190	939	285	220	90	160	175	200	105	1235	3534	168
65	40	90	45	395	50	50	50	40	....	15	25	230	943	45
....	65	85	20	310	....	....	....	....	40	....	20	60	625	30
62	85	85	50	518	105	105	65	25	....	....	25	325	1380	65
127	190	260	115	1223	155	155	115	65	40	15	70	615	2948	140

Ninety grams of syrup or molasses is considered as the average amount that would be consumed in one day by an ordinary person. From Table III it is seen that the lowest average daily consumption of any one of the squad is higher than this ninety grams, while in several cases this amount is more than tripled.

Table IV gives in milligrams the daily consumption of sulphur as sulphites, the total consumption of the subjects, and the daily average consumptions. These last two are calculated to parts of an ounce avoirdupois and tabulated in the columns so headed.

HISTORY AND DEVELOPMENT OF THE LOUISIANA SUGAR INDUSTRY.

The first crop of cane manufactured into sugar on a commercial scale was made by Etienne De Boré in 1795, on the same ground now occupied by the Sugar Experiment Station. This crop sold for $12,000. The development of this industry has been such that now the annual production of raw sugar approaches 400,000 short tons. Assuming that our juice is of average quality and that three sugars are made, we should have an annual production of 25,000,000 gallons of final molasses. As, however, in many instances, only two sugars are made, and in rare cases only one sugar, the annual production of syrups, first, second and third molasses approximates 30,000,000 gallons.

De Boré crushed his cane with a horse mill, feeding single stalks into the mill, and evaporating the juice so obtained in a kettle over an open fire. The steam engine was first introduced in 1822 and rapidly replaced horse power for driving the mills.

The first vacuum pan was introduced in 1830, and this really marked the beginning of the present day processes, and since then the advances have been very rapid.

The filter was introduced in 1840, and in the same year coal was first used as a fuel.

In 1846 the "double pressure" mill was first introduced and was found to very materially increase the amount of juice expressed from the cane, and to furnish bagasse in a state suitable for fertilizing purposes.

TABLE IV.—DAILY CONSUMPTION OF SULPHUR AS SULPHITES, IN MILLIGRAMS.

MAY

Number.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total.	Daily ave.	Total in parts of an ounce avoirdupois.	Average per day in parts of an ounce avoirdupois.
1	88	86	117	99	77	99	130	113	38	51	137	112	73	113	89	71	87	69	73	87	81	1892	90	0.0668	0.0032
2	103	76	100	68	87	105	151	102	36	126	98	81	75	130	109	142	85	73	103	103	99	2012	96	0.0710	0.0034
3	138	112	102	143	143	140	172	224	77	15	109	151	93	117	103	99	77	36	79	51	83	2266	108	0.0800	0.0038
4	159	159	176	95	158	177	225	180	61	88	136	212	205	151	172	249	162	148	231	334	107	3585	171	0.1266	0.0060
5	52	37	9	19	40	36	24	152	68	188	156	104	70	133	90	25	126	146	131	95	8	2169	103	0.0766	0.0036
6	49	22	52	35	38	38	63	245	175	109	161	150	158	171	136	180	105	138	156	110	75	2992	143	0.1056	0.0050
7	27	27	11	14	23	29	34	121	120	105	126	80	70	88	108	93	110	70	58	40	73	1775	84	0.0627	0.0030
8	29	30	43	32	40	57	49	124	148	78	144	162	126	103	75	90	70	78	120	261	53	2510	120	0.0886	0.0042
9	228	328	296	221	311	358	422	454	292	469	155	75	135	84	184	264	227	102	246	728	705	6285	299	0.2219	0.0106
10	187	44	111	122	180	206	164	292	130	71	96	97	70	51	121	97	102	60	79	32	28	2341	111	0.0826	0.0039
11	209	119	248	173	185	133	197	116	...	276	81	92	130	176	264	204	84	148	162	186	97	3280	156	0.1157	0.0055
12	146	333	158	132	211	131	220	125	93	275	118	167	141	107	144	144	107	60	37	139	65	2736	130	0.0966	0.0046

The centrifugal was introduced in 1852, and about this time bagasse was successfully used as fuel.

Norbert Rillieux originated the multiple effect, which was an immediate success, and this process of evaporating cane juice is now in general use.

CLARIFICATION OF THE JUICE.

In addition to the sugars occurring in cane juice are gums, acids, albuminoids, mineral salts, etc. The amount of these substances present varies directly with the pressure employed in extracting the juice from the cane, though the kind of cane, season, maturity, etc., also influence the amount of these substances found in the juice. With the light pressures employed in the old horse mills but little of these substances were extracted. With the evolution of the crushing apparatus there has been a constant increase in the amount of impurities extracted, until now an average Louisiana juice contains from 1½ to 3 per cent. of these objectionable substances. Heat alone will remove a small portion of the gums and albuminoids, but allows practically all acids to remain. These acids exert a very great inverting action on the sucrose, changing it into invert sugar. By adding lime to the juice before heating, more of the impurities are removed than by the action of heat alone, though the greater portion of the gums still remain. Should the lime be added to alkalinity is found to attack the glucose and to form gummy acids which are more objectionable than the impurities removed. If, however, sulphur dioxide is passed into the juice, a large part of the gums, wax, etc., are removed. By next adding lime to the sulphured juice till neutrality is reached phosphates, sulphates, etc., acids, albuminoids, etc., are removed in maximum quantities and the resulting juice is purer than that obtained by the other methods of clarification. Consequently it is possible to crystallize more sugar from our juice and to obtain a superior quality of molasses.

IT IS THEN SEEN THAT IT IS NOT ONLY EXPEDIENT, BUT NECESSARY, TO ADD BOTH SULPHUR DIOXIDE (OR SULPHUR FUMES) AND LIME TO THE JUICE IN THE PROCESS OF CLARIFICATON; THAT

THE EFFECTS OF THESE SUBSTANCES ARE NOT TO INJURE THE QUALITY OR LOWER THE PURITY OF THE PRODUCTS, BUT, ON THE CONTRARY, TO FACILITATE THE PRODUCTION OF SUPERIOR FOOD STUFFS. THE SULPHUR FUMES ARE NEVER ADDED AS A PRESERVATIVE, OR AS A DISGUISE OF INFERIORITY, BUT AS AN ESSENTIAL MEANS OF OBTAINING PURE AND PALATABLE PRODUCTS.

PROCESSES OF MANUFACTURE.

Before going further it is well to understand the difference between syrup and molasses.

A syrup is the juice of sugar cane concentrated by evaporation without the removal of any sugars. This evaporation is generally carried on till the syrup contains 30 per cent. water and 70 per cent solid matter.

Substances other than the sugars are removed in greater or less degree, depending on the details of manufacture. When the concentration of cane juice is carried sufficiently far sugar crystallizes. The sugar is separated from the liquid and this liquid is known as molasses. By further evaporation sugar may be crystallized a second, and even a third time. Then the resulting liquid is called second or third molasses, as the case may be. It has not yet been found possible to crystallize all the sugar from the juice and a third molasses has generally 80 per cent. solid matter, 20 per cent. water and 60 per cent of total sugars.

There are many variations in the general process of making syrups, sugars and molasses, though the principal ones may be classed under three heads:

I. SYRUPS ALONE—OPEN KETTLE PROCESS.

This method is usually employed in the smaller factories, and here the juice after its extraction by three, five or six roller mills, is strained, then sulphured and limed. Heat is then applied to complete the clarification. The precipitated impurities are next removed by settling or filtering or by a combination of settling and filtering. The clarified juice is then concentrated by evaporation in open pans until it reaches the desired density.

II. OPEN KETTLE SYRUPS. SUGARS, AND MOLASSES.

The syrup is obtained as in process I. An additional evaporator (termed a strike pan) is used, in which the syrup is evaporated to the granulation point. The liquid is now run into coolers and the sugar crystals allowed to form. The sugar is removed either by draining off the molasses or by means of the centrifugal.

III. SYRUPS, SUGARS AND MOLASSES—VACUUM PROCESS.

The clarification of the juice is the same as in Process I, and in some small houses the process of evaporation to syrup is the same. The larger and more modern plants evaporate the juice in multiple vacuum effects. The syrup is evaporated to the granulation point in another single vacuum pan. The sugar is separated out by means of the centrifugal. The molasses so obtained is called vacuum molasses.

These methods are, of course, very general as details were deemed unnecessary. The first two processes are but little used, by far the greater portion of juice being worked by the modern vacuum process.

CHEMICAL COMPOSITIONS.

The table (V) taken from Bulletin No. 91 of the Louisiana stations, gives the yields and compositions of the products from an average juice when worked by the vacuum process.

The syrups and molasses eaten by the subjects were analyzed at the Sugar Experiment Station by Dr. F. Zerban and Mr. H. P. Agee. It was deemed wise to make two analyses of the open kettle molasses fed to Squad II, in order to note any effects which the addition of sodium sulphite might have had on this molasses.

TABLE V.

(Yields and Compositions of Sugar House Products from an Average Juice.)

	Pounds	Total Solids	Sucrose	Dextrose	Levulose	Ash	Albuminoids	Amids, etc.	Acids, Gums, etc.
Cane	1,000,000								
Raw Juice	750,000	15.00	12.00	1.00	0.70	0.45	0.10	0.10	0.65
Sulphured Juice	750,000	14.80	12.00	1.00	0.70	0.40	0.02	0.10	0.58
Clarified Juice	750,000	14.70	12.00	1.00	0.70	0.45	0.03	0.10	0.42
Syrup	220,588	50.00	40.80	3.20	2.58	1.50	0.09	0.33	1.50
First Masse Cuite	122,550	90.00	73.44	5.70	2.70	2.70	0.13	0.63	2.70
First Sugar	54,000	98.75	96.00	0.80	0.70	0.80	0.01	0.05	0.39
First Molasses	71,213	80.00	53.60	8.76	8.00	4.00	0.20	0.94	4.50
Second Masse Cuite	63,300	90.00	60.30	9.43	9.43	4.50	0.21	1.08	5.05
Second Sugar	24,000	95.50	85.00	2.90	3.10	2.50	0.06	0.34	1.60
Second Molasses	42,563	80.00	41.70	12.20	12.50	5.35	0.25	1.50	6.50
Third Masse Cuite	37,833	90.00	46.90	13.30	14.50	6.00	0.26	1.70	7.34
Third Sugar	10,000	94.00	80.00	3.80	4.20	3.50	0.07	0.43	2.00
Third Molasses	30,750	80.00	31.70	15.00	16.50	6.30	0.38	2.00	8.20

Table VI gives these analyses:

TABLE VI.—COMPOSITION OF SYRUPS AND MOLASSES FED TO SUBJECTS.

	Syrup	O. K. Molasses 1st week	O. K. Molasses 2d and 3d weeks	Vacuum process Molasses
	%	%	%	%
Total Solids	69.7500	76.4600	76.3900	73.3400
Sucrose	53.1200	39.8300	39.6100	44.1500
Dextrose	5.9900	13.8600	14.2300	7.2400
Levulose	6.6100	15.2200	15.0900	8.6400
Ash	2.1440	3.2180	3.3000	5.4180
Sulphur as Sulphites (S)	0.0405	0.0161	0.0502	0.0928
Sulphur as Sulphates (S)	0.0690	0.0580	0.0790	0.1123
Total Sulphur (S)	0.2400	0.2740	0.3230	0.4350
Free Acids (as malic)	0.4190	0.7270	0.6560	0.6160
Combined Acids (as malic)	1.3020	2.2370	2.2110	4.7600
Gums	0.8440	0.9050	0.9880	2.9190
Total Nitrogen (N)	0.0860	0.1010	0.0820	0.2150
Nitrogen as Albuminoids	0.0120	0.0260	0.0120	0.0390
Nitrogen other than Albuminoids	0.0740	0.0750	0.0700	0.1760
Water	30.2500	23.5400	23.6100	26.6600

The method of determining the sulphur as sulphites was as follows:

Twenty grams of the sample was weighed out and diluted to 350 to 400 cubic centimeters, an excess of phosphoric acid added and 200 cubic centimeters distilled into bromine water. The bromine was boiled off, hydrochloric acid was added and sulphur precipitated as barium sulphate.

A series of experiments conducted at the Sugar Experiment Station has failed to show any *free sulphurous* acid in Louisiana molasses, and has established the fact that even in raw juices and unsulphured cane products there is volatile sulphur which is estimated as sulphite sulphur in the usual methds for determining this substance. A sample of raw juice taken immediately after crushing showed 15.66° Brix, 3 milligrams per kilo of volatile sulphur and 45 milligrams per kilo of total sulphur. Demerara No. 74 cane grown on the Experiment Station was crushed in the laboratory mill, giving a juice of 15° Brix. This juice was evaporated to a syrup of 70° Brix, which syrup was found to contain eleven milligrams per kilo of volatile sulphur, when treated by the method given for the determination of sulphites. This syrup also contained 1,629 milligrams per kilo of total sulphur.

The nature of these volatile sulphur compounds has not yet been determined, though it has been found that hydrogen sulphide forms a part of this volatile sulphur.

MEDICAL EXAMINATION AND SUPERVISION.

The physician in charge, or one of his assistants, paid occasional visits to the squad and gave advice and suggestions relative to the work in hand. Once during each weekly period each subject was taken to the laboratory of the State Board of Health, where he was examined by Dr. P. E. Archinard and his assistants, Drs. J. J. Archinard and E. O. Trahan. This examination consisted in a general physical inspection, and in taking blood samples for counting the different corpuscles, and for hæmoglobin test.

Tables VII to XVIII, taken from Dr. Archinard's report made to the Board of Health, give the data concerning the blood.

TABLE VII.

SPECIAL BLOOD EXAMINATION CASE No. 1

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	5,012,000	8,600	95%	63	22	14	1
II. May 2 May 9	4,984,000	9,600	95%	64	21	12	3
III. May 9 May 15	4,992,000	8,200	95%	66	22	11	1
IV. May 16 May 22	5,008,000	8,000	100%	63	23	13	1
V. May 23 May 29	5,052,000	7,920	100%	69	20	11	0

TABLE VIII.

SPECIAL BLOOD EXAMINATION CASE No. 2

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	4,850,000	6,302	95%	62	20	12	4
II. May 2 May 9	4,960,000	6,220	95%	64	22	13	1
III. May 9 May 15	4,968,000	6,420	100%	64	24	11	1
IV. May 16 May 22	5,020,000	6,520	100%	62	25	12	1
V. May 23 May 29	5,088,000	7,100	100%	66	23	11	0

TABLE IX.

SPECIAL BLOOD EXAMINATION CASE No. 3

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. April 25 May 1	3,560,000	8,800	85%	64	20	13	3
II. May 2 May 9	3,888,000	8,300	85%	66	21	11	2
III. May 9 May 15	4,288,000	8,380	90%	63	25	12	0
IV. May 16 May 22	4,512,000	8,250	90%	70	20	10	0
V. May 23 May 29	4,592,000	8,120	95%	67	23	9	1

TABLE X.

SPECIAL BLOOD EXAMINATION CASE No. 4

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	4,192,000	9,200	95%	62	20	13	1
II. May 2 May 9	4,448,000	6,400	100%	60	21	12	0
III. May 9 May 15	4,596,000	6,420	100%	64	22	14	0
IV. May 15 May 22	4,604,000	6,600	100%	63	20	12	1
V. May 23 May 29	4,656,000	6,400	100%	71	19	10	0

TABLE XI.

SPECIAL BLOOD EXAMINATION CASE No. 5

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	5,060,000	8,400	95%	63	26	10	1
II. May 2 May 9	5,136,000	8,000	100%	62	28	10	0
III. May 9 May 15	5,204,000	8,200	100%	62	27	10	1
IV. May 16 May 22	5,226,000	8,240	100%	65	27	8	0
V. May 23 May 29	5,252,000	8,160	100%	62	26	10	2

TABLE XII.

SPECIAL BLOOD EXAMINATION CASE No. 6

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	3,960,000	10,240	85%	67	20	13	3
II. May 2 May 9	4,472,000	9,780	85%	62	26	11	1
III. May 9 May 15	4,560,000	8,840	90%	62	21	11	6
IV. May 16 May 22	4,604,000	8,600	90%	65	25	10	0
V. May 23 May 29	4,656,000	8,400	95%	66	26	8	0

TABLE XIII.

SPECIAL BLOOD EXAMINATION CASE No. 7

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	4,960,000	7,600	90%	70	16	12	2
II. May 2 May 9	5,072,000	8,000	95%	65	22	12	1
III. May 9 May 15	5,088,000	7,820	95%	66	21	12	1
IV. May 16 May 22	5,124,000	7,440	95%	66	24	9	1
V. May 23 May 29	5,136,000	7,500	100%	65	24	10	1

TABLE XIV.

SPECIAL BLOOD EXAMINATION CASE No. 8

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	4,806,000	6,400	90%	54	32	13	1
II. May 2 May 9	4,944,000	6,200	95%	62	27	10	1
III. May 9 May 15	4,960,000	6,300	95%	62	27	10	1
IV. May 16 May 22	5,040,000	6,420	95%	66	21	10	3
V. May 23 May 29	5,056,000	6,400	95%	71	20	9	0

TABLE XV.

SPECIAL BLOOD EXAMINATION CASE No. 9

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	4,860,000	8,200	85%	64	27	9	0
II. May 2 May 9	4,768,000	8,400	85%	63	25	11	1
III. May 9 May 15	4,786,000	8,420	85%	66	23	8	3
IV. May 16 May 22	4,848,000	8,240	90%	70	23	8	0
V. May 23 May 29	4,880,000	8,440	90%	63	27	10	0

TABLE XVI.

SPECIAL BLOOD EXAMINATION CASE No. 10

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	4,224,000	8,200	90%	60	27	10	3
II. May 2 May 9	4,472,000	8,600	90%	64	24	11	1
III. May 9 May 15	4,604,000	8,240	90%	62	24	14	–
IV. May 16 May 22	4,624,000	8,200	90%	62	26	11	1
V. May 23 May 29	4,640,000	8,000	95%	69	22	9	–

TABLE XVII.

SPECIAL BLOOD EXAMINATION CASE No. 11

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimeter	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	3,928,000	8,200	90%	70	18	12	0
II. May 2 May 9	4,730,000	8,000	95%	69	18	12	1
III. May 9 May 15	4,832,000	8,240	95%	68	21	10	1
IV. May 16 May 22	4,860,000	8,380	95%	71	20	9	0
V. May 23 May 29	4,864,000	8,000	95%	69	19	11	1

TABLE XVIII.

SPECIAL BLOOD EXAMINATION CASE No. 12

DURING THE FIVE PERIODS.

This examination consists in count of red and white blood cells (Thomas-Zeiss apparatus), estimation of hæmoglobin (Talquist's method), and differential leucocyte count.

Period	Red blood cells per cubic centimeter	White blood cells per cubic centimetes	Haemoglobin	Polymorphous leucocytes per one hundred white cells	Small lymphocytes per one hundred white cells	Large lymphocytes per one hundred white cells	Eosinophile leucocytes per one hundred white cells
I. Apr. 25 May 1	4,704,000	6,200	90%	63	22	10	–
II. May 2 May 9	4,596,000	8,400	85%	66	26	6	2
III. May 9 May 15	4,640,000	8,000	90%	64	25	10	1
IV. May 16 May 22	4,720,000	8,120	90%	65	24	9	2
V. May 23 May 29	4,728,000	8,140	90%	71	20	8	1

In discussing Tables VII to XVIII, Dr. Archinard says: "It will be noticed that the red blood cells have rather a low count. This may be explained in several ways. First, the blood was always drawn and counted about two hours after the subject's dinner; second, because in our latitude the average number of blood cells per cubic centimeter is rather below the five million mark; and, third, because in my personal experience the negro race has a lower erythrocyte count than the Caucasian race. The number of white blood cells does not seem to have been affected, the count being rather higher than the average normal. The hour of examination is no doubt chiefly responsible for this."

"The differential leucocyte count, practically normal, shows that no disease whose recognition depends on the character and number of those elements existed in our subjects."

At the beginning of the experiment each subject was examined regarding the condition of his lungs, stomach, intestines, urine, etc.

Table XIX gives these data. (See page 41.)

At the close of Period V the same examinations were made and showed no material change in any subject.

The daily weights of the subjects, taken from 4:30 to 5 p. m., are given in Table XX. (See page 42.)

Diagram A, here included, shows graphically these fluctuations in weights. The lines marked "Subject I," etc., show the average weights for each weekly period, and the very light lines connect points which represent the daily fluctuations in weights. Those lines marked "Squad I," etc., show the averages of each squad of four for each weekly period.

In the scale here one small square vertically represents one pound, while five of these squares horizontally represent one day.

The very heavy lines marked "Entire Squad of Twelve," show the averages of the whole squad for the weekly periods.

Here the vertical scale is ten small squares to one pound, and horizontally five small squares to one day.

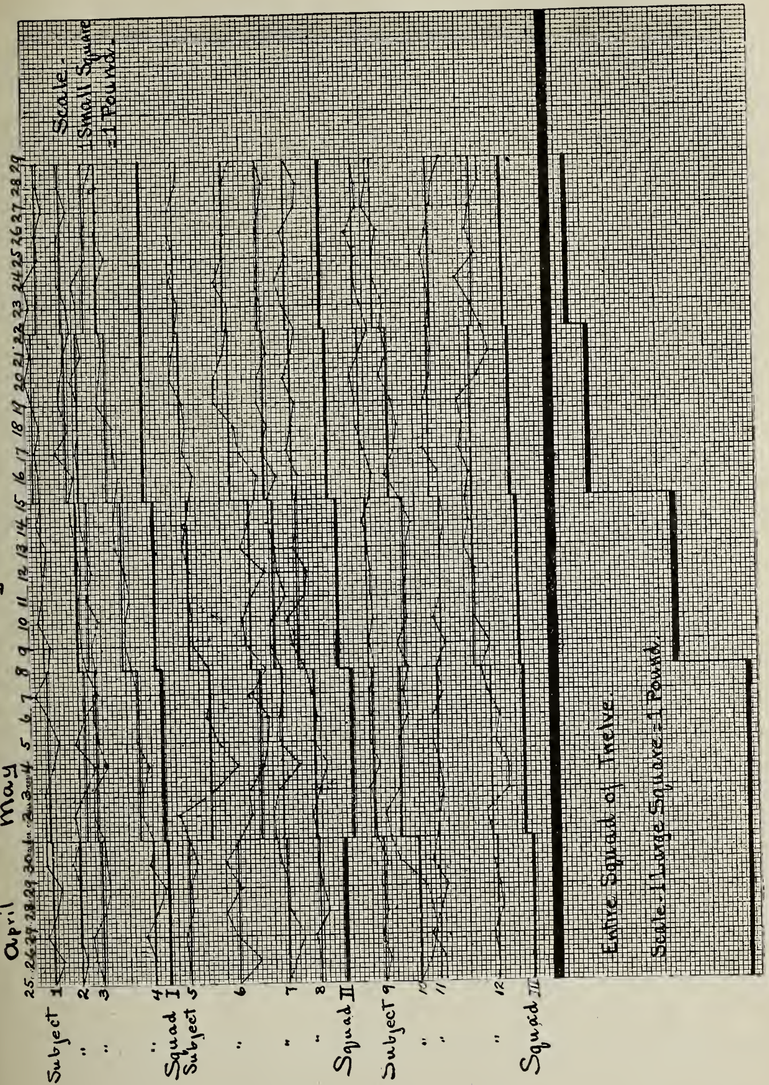
Diagram A.
April
May
25. 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Scale - 1 Small Square = 1 Pound.
Subject 1
" 2
" 3
" 4
Squad I
Subject 5
" 6
" 7
" 8
Squad II
Subject 9
" 10
" 11
" 12
Squad III
Entire Squad of Twelve.
Scale - 1 Large Square = 1 Pound.

Regarding his examinations and observations of the subjects, Dr. Archinard, in his report to the Board of Health, says:

"The twelve men remained in perfect condition, with the few exceptions mentioned below, during the entire five weeks of the observations and at no time were we delayed or forced to deviate from our daily programme.

"The few exceptions were these: On May 3 Nos. 8 and 12 became engaged in an argument (as they explained it) the outcome of which was that No. 8 hit No. 12 in the mouth, knocking out three teeth. No. 12 was unable on this account to take solid food for three days, but continued to eat molasses with a spoon. No. 8's hand was dressed with hydrogen peroxide.

"On May 4, Nos. 5, 6 and 7 reported loose bowels, but there was no decrease in appetite. One tablespoonful of ordinary chalk mixture sufficed to remedy this.

"On May 5, Nos. 1, 2, 4, 9 and 10 reported loose bowels, appetite normal. One dose of ordinary chalk mixture relieved this trouble.

"On May 19 No. 12 complained of headache after running a foot race, and ate very little supper. Temperature, 99 2-5. Next morning his temperature was 100 2-5 and he complained of sore throat. Quinine and phenacetine (three grains each, three times a day) were given this day and the next,, after which he felt better and nothing of his ailment remained.

"On May 27, No. 9, who had been well, developed an eruption which proved to be one of tertiary syphilis, but this seemed to incommode him very little."

TABLE XIX.—PHYSICAL CONDITION OF TWELVE SUBJECTS DURING THE FIRST WEEK OF OBSERVATION, APRIL 25 TO MAY 1.

Subject	Headache and other nervous symptoms	Respiratory symptoms, cough, expectoration, difficult breathing, palpitation	Heart	Pulse regular full	Lungs	Respiration per minute	Temp.	Stomach	Intestines	Urine
1	None	None	Normal	Sitting 76 Standing 82	Normal	24	98 2-5	Good	Good	Normal
2	None	None	Normal	Sitting 74 Standing 82	Normal	19	98 3-5	Good	Good	Normal
3	None	None	Normal	Sitting 75 Standing 82	Normal	19	98 3-5	Good	Good	Normal
4	None	None	Normal	Sitting 79 Standing 80	Normal	20	98 2-5	Good	Good	Normal
5	None	None	Normal	Sitting 79 Standing 82	Normal	18	98 2-5	Good	Good	Normal
6	None	None	Normal	Sitting 75 Standing 85	Normal	20	98 3-5	Good	Good	Normal
7	None	None	Normal	Sitting 72 Standing 78	Normal	20	98 3-5	Good	Good	Normal
8	None	None	Normal	Sitting 78 Standing 86	Normal	19	99 2-5	Good	Good	Normal
9	None	None	Normal	Sitting 74 Standing 85	Normal	26	98 3-5	Good	Good	Normal
10	None	None	Normal	Sitting 78 Standing 86	Normal	18	98 2-5	Good	Good	Normal
11	None	None	Normal	Sitting 74 Standing 82	Normal	19	98 3-5	Good	Good	Normal
12	None	None	Normal	Sitting 80 Standing 88	Normal	21	98 3-5	Good	Good	Normal

TABLE XX—DAILY WEIGHTS OF SUBJECTS—POUNDS.

SUBJECTS	1	2	3	4	5	6	7	8	9	10	11	12
April 26	159	153	124	130	203	183	....	141	126.5	128	140	129
27	162	154	124.5	131.5	203.5	188	149	141.5	128	127	142.5	130
28	160	154	122	129.5	202	190	152	139	127	127.5	141	128
29	159	154	121	127.5	202.5	187	152	140	127.5	129	139.5	128.5
30	162	155.5	121.5	130.5	201	190	153.5	141	127	134	142.5	129.5
May 1	162	154	122	130	202.5	187	154.5	141	129	136	141.5	130
Average for period	160.7	154.1	122.5	129.8	202.4	187.5	152.2	140.6	127.5	130.2	141.1	129.1
May 2	162	155	124	132	204.5	184.5	155	142	129	137	141	131
3	162	153	124	132	197	185	154	143	130	134	140	127.5
4	160	151	121	130.5	192	182	149.5	139	128	134	141	127.5
5	159	154.5	123	133	196	181	153.5	141.5	130	134	141.2	130
6	161	153	124	133	198.5	181	153.5	141	130	132	142	129.5
7	164	150	123.5	133	198	184	153	141.5	130	133	140	131.5
8	161	152	123.5	134	198	181	153	143	129	132	141	132
Average for period	161.3	152.6	123.3	132.5	197.7	182.6	153	141.1	129.4	133.7	140.9	129.9
May 9	160.5	153	124	135	201	185	155	144	130	134	139	130
10	163	153.5	122.5	135	201	185.5	154.5	145	129	132	141.5	133
11	162	153.5	125	134	202	184	152	141.5	129.5	132.5	140	133
12	161.5	153	124	135	202	181	153.5	141	129.5	132	140	133
13	161.5	154	125	136.5	203	186	154	143.5	130	132	140	135
14	163	154.5	126	137	202.5	184.5	155.5	143	131	131	139	134
15	162	155	126	136.5	201.5	183	155.5	143	129.5	133	140	134.5
Average for period	162	153.8	124.6	135.6	201.9	184.1	154.3	144.3	129.8	132.4	139.9	133.2
May 16	162.5	154	126	136	200.5	182.5	153.5	144	129	136	140	134
17	163	158	126.5	137	202.5	186	156.5	146	130.5	134	143	135
18	162	155	126.5	137	202	187	155	145	132	133.5	143	135
19	163.5	157	126	140	202.5	191	157	144.5	132	134.5	143	136
20	165	156.5	127.5	139.5	205	191	157	146.5	133	137	141.5	132

May 21	164	155	125.5	139	204.5	189	155	145	131	135	141.5	129.5
22	165	154.5	126	139.5	203.5	188.5	156	144	129	136.5	142	130.5
Average for period	163.6	155.7	126.2	138.3	203	187.9	155.7	145	130.9	135.2	142	133.1
May 23	164	155	126	140	203	188	156	146.5	130.5	136	141.5	133
24	165	157	127	140	205	190.5	157	148	132	138	142	136
25	162	157	124	138	204	189	156.5	146	132	138	143	132
26	162.5	156.5	124.5	140	205	189	157	147	133.5	137	142	133.5
27	161	155	124	140	205	189	156	144	131	140	141	133
28	162	156.5	124	140	203.5	189	155.5	143.5	131.5	139	140.5	130.5
29	162	157	122.5	140	203	189	157	146	132	139	138.5	131
Average for period	162.6	156.3	124.6	139.8	204	188.8	156.4	146	131.9	138	141.2	132.6

SUMMARY.

The object of the experiment was to observe the effects on human subjects of feeding syrups and molasss of high sulphite content.

Negroes in good health were selected on account of:

1. Their fondness for foods of this kind.

2. Their entire ignorance of the supposed evil effects of the sulphites in the food.

3. Ease with which they could be controlled.

The subjects while in jail were given such liberties as to render their confinement easy, and were required to do such work as that to which they were accustomed. The subjects were allowed to eat the syrups, etc.—not forced to eat them—in connection with a normal diet.

The experiment was divided into five periods of one week each, designated as Periods I, II, III, IV and V. During Period I the subjects were fed on a normal diet without syrup or molasses, and data recorded in order to ascertain their normal conditions. During Periods II, III and IV they were allowed syrup or molasses as they desired to eat it along with their regular food. Observations were made during these periods as to the effects produced.

During Period V they were again fed without molasses and observations and examinations were made. The articles of food were clean, wholesome, and substantial, and the general conditions such that should harm have resulted it could have been concluded that the sulphites in the syrups, etc., were the cause. The control and supervision of the subjects were such that they could not, had they been so inclined, deviate from the daily programme.

The subjects were in ignorance of the presence of sulphites in their food, and consequently there was no tendency to produce unnatural mental conditions by anticipation of harm resulting from eating the syrups, etc.

CONCLUSIONS.

From the foregoing tabulated data and from the observations of the subjects and from their own statements as to their condition of health, etc., while considering the effects of regular hours, sanitary and hygienic surroundings, and general contentment, it is believed that the following conclusions from Dr. Archinald's report to the Board of Health are thoroughly justified:

1. "From a practical standpoint the experiments on molasses feeding were carried on for a sufficient length of time and on a scale large enough to test the effects of these foods on the human subject in ordinary health.

2. "We believe that our mode of examination is the fairest way to test the effects of substances on the human subject under natural conditions, for here we had a large number of docile and ignorant men who did not know what was expected of them, were neither frightened nor awed, and put in the same condition as persons who partake of molasses as a food, eating of the same according to their taste and liking, and the effects on them carefully and faithfully noted from day to day and week to week.

3. "As in none of our cases were the body functions interfered with, in each one the body weight increased, and as the blood steadily increased in number of red blood cells, in the percentage of hæmoglobin, etc., it must be admitted that these subjects were gaining in health and neither doing nor taking anything prejudicial to their physical well being.

4. "A careful survey of Table XX, on weights, and of Tables VII to XVII, on blood examination, will satisfy any one that the subjects gradually improved in weight, body functions and blood conditions, notwithstanding the fact that during Periods II, III and IV they daily took a considerable quantity of syrup or molasses containing appreciable quantities of sulphur as sulphites.

"Reference to Tables III, XIX, XX, and VII to XVII, will demonstrate that the amount of molasses consumed, although in some instances very large, does not seem to have had any deleterious effects on the functions, weight and blood condition of the subjects, but rather to the contrary.

"We are, therefore, free to conclude that molasses feeding, even when said molasses contains as high as over 900 milligrams per kilo of sulphur as sulphites, can be carried on under ordinary circumstances without prejudicial effect to health."

Louisiana Bulletin No. 95. September, 1907.

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College

BATON ROUGE

VICTIM OF STOMACH WORMS

BARE-LOT vs. GRASS-LOT

IN RELATION TO STOMACHAL AND INTESTINAL PARASITISM OF LAMBS.

FURTHER EXPERIMENTS

By W. H. DALRYMPLE, M. R. C. V. S.

BATON ROUGE
The State, Official Journal State of Louisiana
1907

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BARE-LOT vs. GRASS-LOT

IN RELATION TO

STOMACHAL AND INTESTINAL PARASITISM OF LAMBS.

FURTHER EXPERIMENTS.

BY W. H. DALRYMPLE.

During previous experiments by the Veterinary Division of this Station to endeavor to obtain some practical method by which lambs could be raised free, or virtually so, from nodule-disease of the intestines, it was found that notwithstanding the success attained by the "bare-lot" method, stomach worms (*Haemonchus contortus*) were always found in considerable numbers in the abomasum, or fourth compartment of the lambs' stomachs.

It was decided, in the early part of the present year, to continue the experiments with nodule-disease, and to include, also, treatment directed against stomach worms, and, at the same time, test the difference in the results, if any, that might be secured with lambs raised on a grass-lot, as against those kept on a bare-lot, or one free from grass.

The bare-lot used was the same as that employed in last year's work, but, after the lambs were taken off in September, 1906, the ground was thoroughly ploughed and harrowed, and left in that condition until the latter part of February, when it was hoed and raked over and put in final shape for the reception of the ewes and lambs. (See description of lot in Bulletin No. 83, page 4.)

The grass-lot had not been occupied by sheep at all since January, 1904, when three lambs occupied it for about six months, but which, when butchered and examined, did not have any sign of nodule-disease.

As it was decided to use check, or control, animals, both in the pasture and bare-lot tests, each lot was divided lengthwise by a suitable fence, and a small shed for shelter was provided for each bunch of ewes and lambs. The sheep had common salt before them all of the time in small boxes, and fresh water was provided out of wooden tubs. A little crushed grain was fed out of troughs once a day, and the bare-lot bunches were "soiled," or received cut green food out of racks. In short, the only difference in the method of feeding the ewes and lambs in the bare-lot and on pasture, was that the latter had to obtain their green food by grazing, while the former received theirs from racks.

Thirteen native and common grade ewes, with young lambs, were purchased for the experiments. The oldest lambs were not more than two or three weeks, the rest, younger, and were from an extensive area of pasture country in the neighborhood where sheep were not numerous and where the chance of previous infestation of the lambs, at such an early age, was slight, if any. It should be stated, however, that the ewes had previously belonged to a flock in another section that was infested with both nodule and stomach worms.

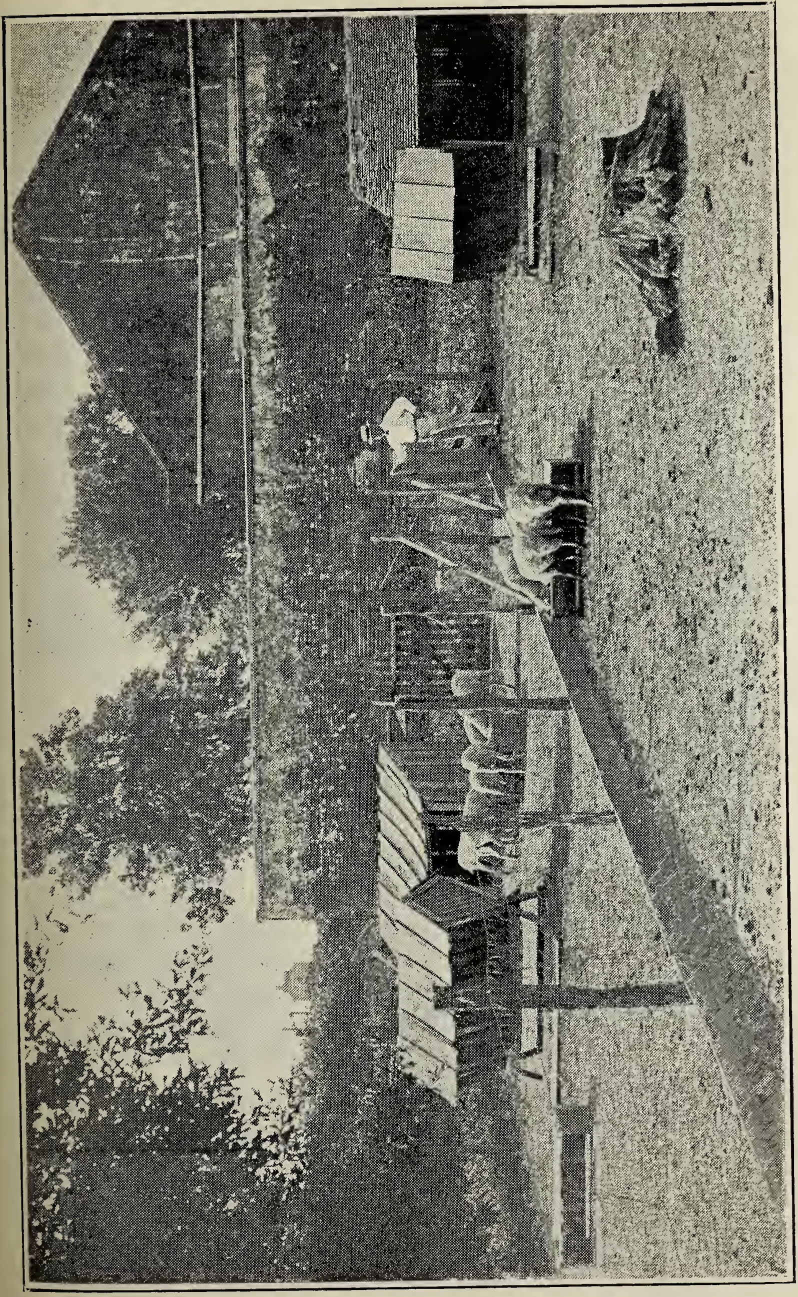
On March 6, 1907, two ewes, with their lambs, were placed, without any previous treatment, in a section of the bare-lot provided for the control, or check, animals; and three ewes and lambs were put in the control-division of the grass-lot. The remaining eight ewes and eight lambs were retained in a covered shed for treatment of the ewes before turning both into the lots.

TREATMENT OF EWES.

March 15.—Each of four of the ewes was given 4 ounces of a 1 per cent solution of coaltar creasote, and, on the following day, each of the remaining four ewes received a mixture of 1 drachm of carbon bisulphide and 1 drachm of absolute alcohol, in 4 ounces of sweet milk.

March 18.—The above treatment was repeated, with the exception that the carbon bisulphide was mixed with 2 ounces of Carron oil (equal parts of raw linseed oil and lime-water) instead of the alcohol and sweet milk. The Carron oil was found to be quite a satisfactory vehicle for the bisulphide when the mixture was well shaken before its administration.

The drenching was accomplished by means of a piece of one-quarter-inch rubber tubing, about three and one-half feet



SHOWING DIVISIONS OF BARE-LOT.

long, with a hard-rubber nozzle inserted in the lower end, and a glass funnel in the upper. It was found that by gripping the rubber tube, just below the insertion of the funnel, with the under border of the left hand, the flow of the material could be easily regulated. An assistant introduced and held the nozzle in the animal's mouth.

March 19.—Each of the eight ewes received 8 ounces of a saturated solution of magnesium sulphate (Epsom salt).

March 21.—The udders and surrounding parts of the eight ewes were washed with a 3 per cent solution of carbolic acid and water to destroy any infection that might be present; after which they, with their lambs, were placed in their respective lots.

The above line of treatment was adopted with a view of destroying and dislodging parasites, either free nodule-worms or stomach worms, that might be present in the ewes, as well as to destroy any infection that might be on the surface of the udders, teats, etc., before placing them, with their lambs, on the grass and bare-lots which they were to occupy.

May 18.—One of the three check ewes died in the grass-lot. Postmortem examination revealed extensive nodule-disease, with a number of nodule worms (*Oesophagostoma columbianum*) free in the large intestine, and a few stomach worms in the fourth stomach.

May 25.—A second check ewe died in the grass-lot, showing numerous nodules and several stomach-worms.

June 2.—Two stray dogs, unfortunately, gained access to the check or control-division of the grass-lot and killed two of the lambs. One of the lambs showed numerous nodules, with a great number of stomach worms; the other, a few stomach worms, but no nodules that could be seen.

June 9.—The last one of the three control ewes, in the grass-lot, died. She was extensively affected with nodule-disease.

July 1.—One of the bare-lot ewes, which had received coal-tar creasote solution, died in the experiment-division. This ewe had always appeared somewhat emaciated and unthrifty. On account of the hot weather, decomposition had set in so rapidly that a postmortem examination was not made. There could be little question, however, of her being severely affected with nodule-disease.

It would seem that sheep which have survived the effects of stomach worms, during lambhood, frequently succumb to nodule-disease of the intestines when confined to areas where this disease is prevalent.

July 10.—The lambs in both divisions of the bare-lot were weaned by the removal of their mothers.

July 15.—The grass-lot lambs in the experiment division were weaned in a similar manner. It will be rememberd, as already mentioned, that the last of the control ewes in the grass-lot died on June 9.

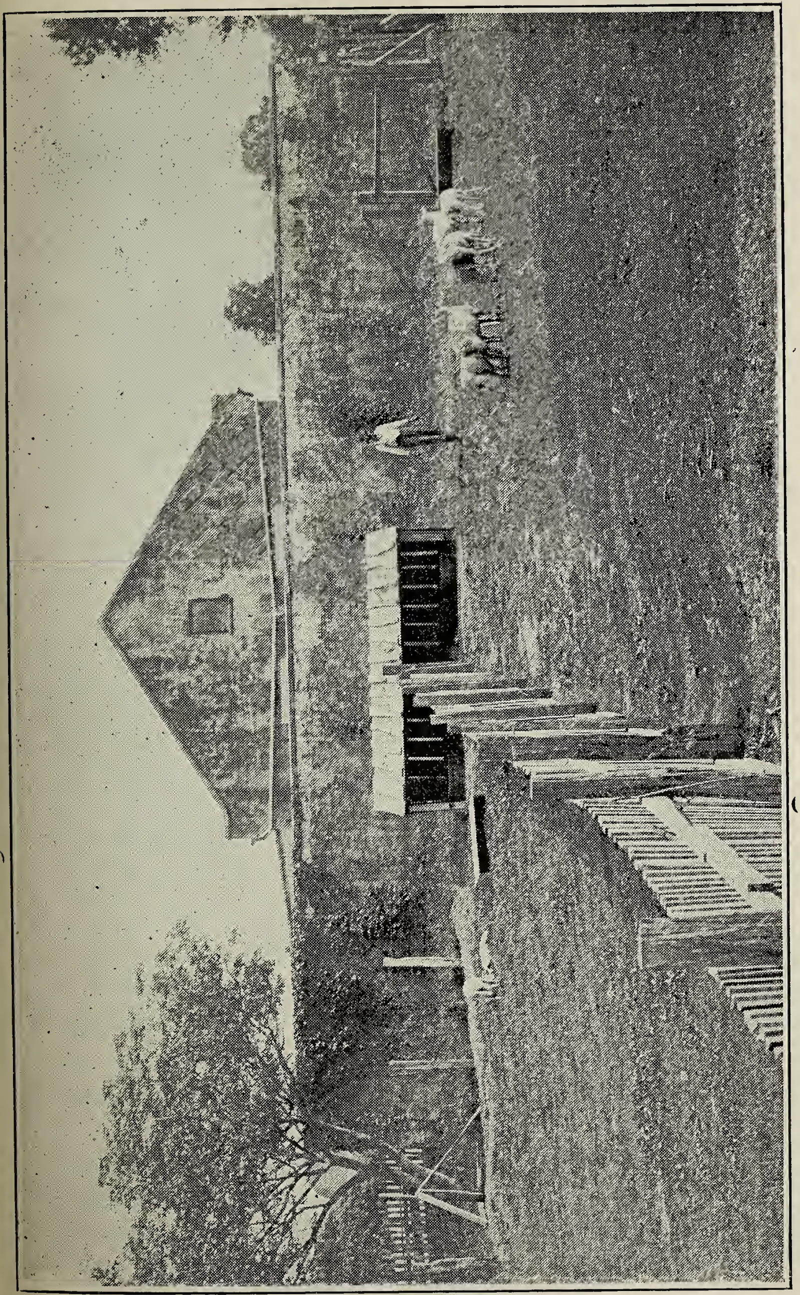
July 28.—The remaining check lamb, in the grass-lot, died. Postmortem examination revealed great numbers of stomach worms in the fourth stomach, but no nodules, so far as could be discovered. A picture of this lamb, taken the evening before it died, may be seen on the front page.

With the exception of the unthrifty ewe which died on July 1, no losses were met with among the ewes and lambs in the bare-lot divisions.

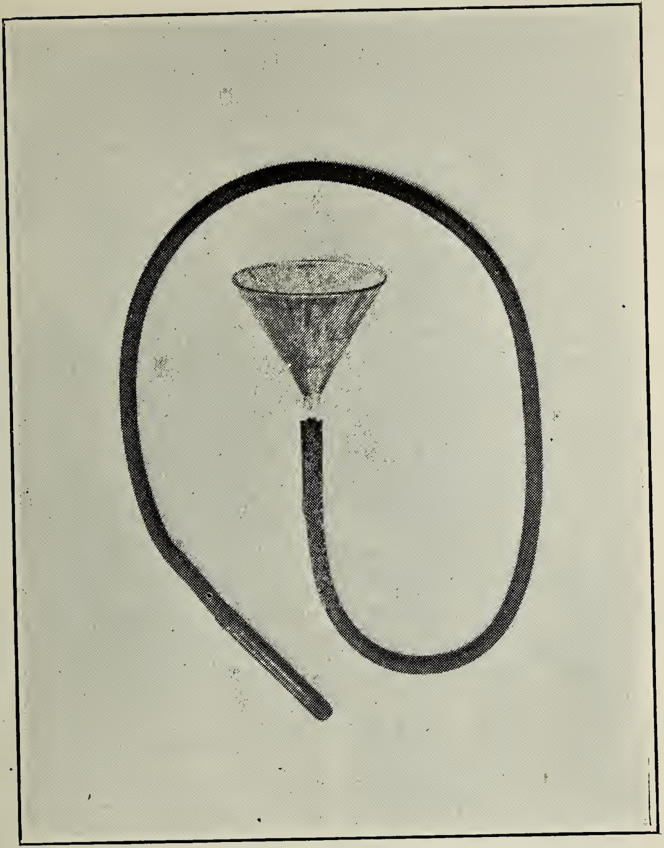
TREATMENT OF LAMBS IN GRASS-LOT.

July 17.—One lamb, whose mother had received the coal-tar creasote treatment, was given 3 ounces of the same solution. And another lamb, whose mother had been treated with carbon-bisulphide in linseed oil and lime water, was drenched with one and one-half ounces of the same mixture, which was equivalent to three-quarters of one drachm of the bisulphide of carbon. The remaining two lambs in this division did not receive any medicine at all.

July 24.—The same two lambs received similar quantities of the same medicinal agents.



SHOWING DIVISIONS OF GRASS-LOT.
(Photo taken after the loss of two ewes and two lambs in Control-Division.)



DRENCHING-TUBE.

TREATMENT OF LAMBS IN BARE-LOT.

July 17.—The treatment of the lambs in the bare-lot was, in every respect, a duplicate of that followed in the case of those in the grass-lot, and the medicines were administered on the same dates—viz., July 17 and 24.

Our line of treatment was aimed at (1) to test what effect, if any, the previous treatment of the mothers might have on the infection of the lots, and on the lambs that were not, themselves, treated; (2) to see if the two treated lambs would show better results than the two untreated ones (in both grass and barelots);

and (3) to note the difference, if any, in the efficacy of the two medicinal agents used.

No further treatment was given the lambs in either grass or bare-lots, and on August 10th all of them (10 in number) were butchered and their stomachs and intestines examined for stomach worms and nodules.

POSTMORTEM EXAMINATIONS.

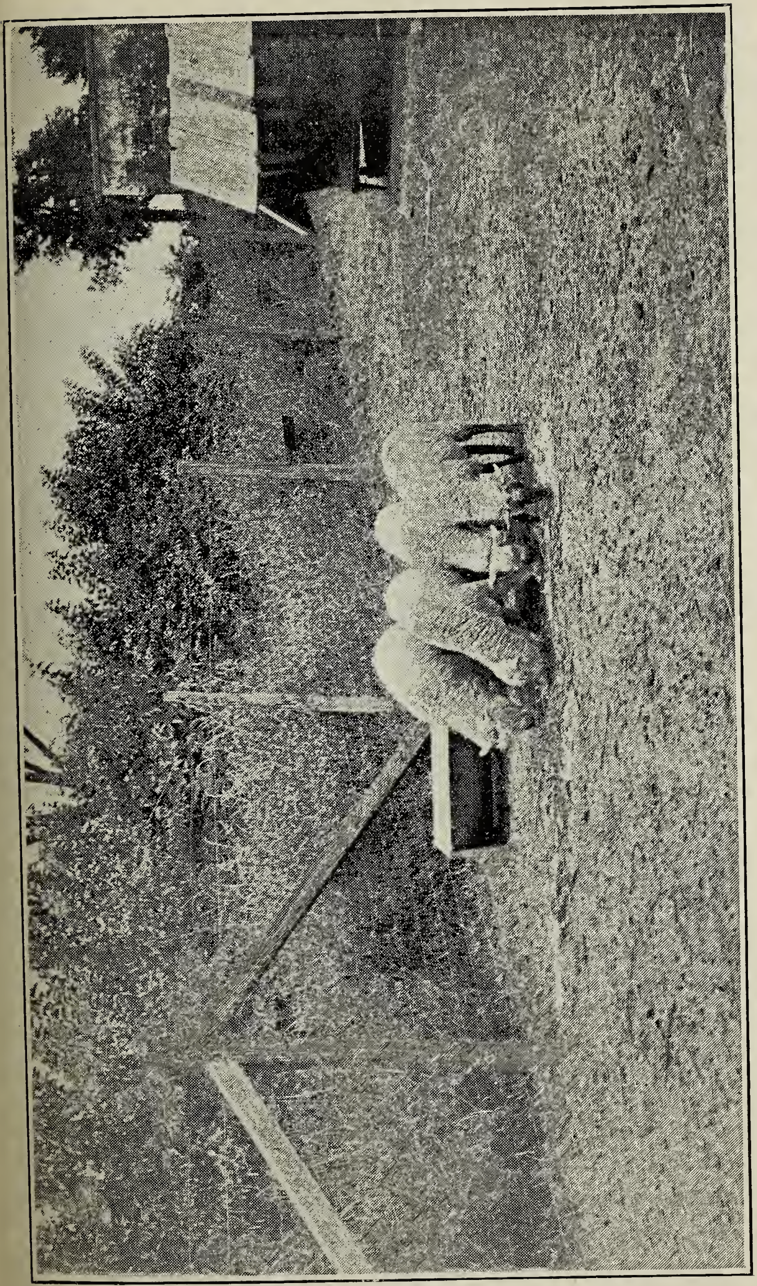
BARE-LOT.

Experiment-Division in Which the Four Ewes and Two of the Lambs Had Received Treatment.

1. Ewe lamb. Fairly nourished. Treated twice with coaltar creasote solution.
   Nodules: About two or three small nodules on large intestine.
   Stomach worms: Numerous.
2. Ram lamb. Well nourished. Received no treatment.
   Nodules: One or two small nodules on large intestine.
   Stomach worms: Less numerous than in previous case (No. 1).
3. Ram lamb. Well nourished. Treated twice with carbon bisulphide in Carron oil.
   Nodules: About two or three small nodules present.
   Stomach worms: Very few.
4. Ewe lamb. Fairly nourished. Received no treatment.
   Nodules: One or two small nodules observed.
   Stomach worms: Not very numerous.

Check or Control-Division in Which Neither Ewes nor Lambs Had Received Any Medicinal Treatment.

1. Ram lamb. Well nourished.
   Nodules: Three or four small nodules on large intestine, and about half a dozen scattered along small intestines.
   Stomach worms: Very numerous. That is to say, they could be found covering almost, if not every part of the mucous lining of the stomach.



EXPERIMENT-LAMBS IN BARE-LOT.

2 Ewe lamb. Well nourished.
Nodules: No nodules that could be detected.
Stomach worms: Very numerous—similar to previous case.

GRASS-LOT.

Experiment-Division in Which the Four Ewes and Two of the Lambs Had Received Treatment.

1 Ewe lamb. Poorly nourished. Treated twice with coaltar creasote solution.
Nodules: Almost negative.
Stomach worms: Extremely numerous. This lamb showed marked symptoms of acute internal parasitism.

2. Ram lamb. Well nourished. Received no treatment.
Nodules: About a dozen small nodules present.
Stomach worms: Moderately numerous.

3. Ewe lamb. Well nourished. Treated twice with carbon bisulphide in Carron oil.
Nodules: About a dozen small nodules present.
Stomach worms: Quite numerous.

4. Wether lamb. Condition poor. Received no treatment.
Nodules: One or two small nodules present.
Stomach worms: Moderately numerous.

Check or Control-Division in Which Neither Ewes nor Lambs Had Received Any Medicinal Treatment.

The three lambs originally occupying this division had all died previous to the examination of the others; the postmortem findings have already been recorded.

We do not know that the terms used convey an intelligent idea of the number of stomach worms present in each case. These parasites are exceedingly difficult to count in a severe attack. We might say, however, that the numbers ranged from a few straggling ones, here and there, over the mucous lining of the stomach, as in the case of Ram Lamb No. 3, which was treated with the carbon-bisulphide mixture, in the Experiment-

Division of the Bare-Lot, to a "seething mass" of the worms, covering all parts of the mucous membrane, as was the case in Ewe Lamb No. 1, which received coaltar creasote solution, in the Experiment-Division of the Grass-Lot.

INFERENCES AND REMARKS.

The parasitic infection, both nodule and stomach worms, was, doubtless, introduced on to the lots by the purchased ewes.

The lambs were somewhat mixed as to breeding and quality, and a little irregular as to size and age.

All of the lambs, including controls, on the bare-lot were in marketable condition, and the carcasses were purchased by a leading local butcher.

Only two, out of the four lambs on the experiment-division of the grass-lot, were in condition for the market, and these were bought along with the bare-lot bunch.

No losses occurred, either in ewes or lambs (two of each) in the control-division of the bare-lot.

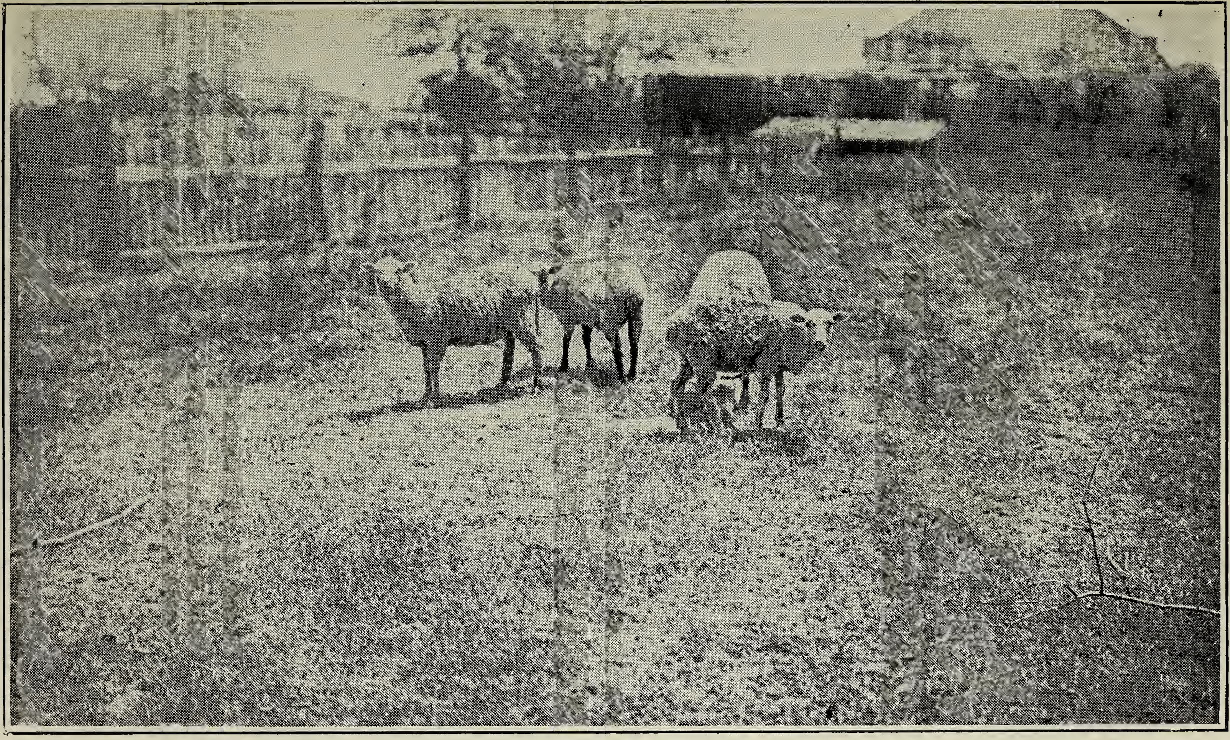
All of the ewes (three in number) and one lamb died in the control-division of the grass-lot, independent of the two lambs that had been destroyed by dogs.

One delicate ewe (out of four) died in the experiment-division of the bare-lot.

None of the four ewes died in the corresponding division of the grass-lot.

None of the four lambs died in the experiment-divisions of either the grass or bare-lots. At the same time, all of those in the bare-lot were in marketable condition when butchered, while only two of those in the grass-lot were in condition for the market—one of the remaining two being in poor flesh; the other, ailing as the result of acute internal parasitism.

Notwithstanding that all of the lambs were, more or less, infested with stomach worms, the uniformly good condition of those in the bare-lot (both controls and others) showed that their health was little, if at all, impaired; while, at least, two of the experiment-division grass-lot lambs did not thrive sufficiently to be considered fit for the butcher.



Experiment-Lambs in Grass-Lot.

On the whole, the lambs raised by the bare-lot method were, in every way, more satisfactory than those raised on the grass-lot.

As only one ewe died out of eight that had received medicine, it is thought probable that the treatment had a beneficial effect, both on the ewes and in preventing, to some extent, the transmission of infection to the lots, as none of the untreated lambs of the treated mothers had died up to the time of slaughter, while the three untreated ewes died in the control-division of the grass-lot, although those in the bare-lot division did not seem to suffer.

The effect of the few nodules found on the intestines might be considered as negative, so far as interfering with the nutrition and development of the lambs, for market, was concerned, as they were very small, and occupied but a minute area of the absorbing surface of the bowel.

The test, in these experiments, may be looked upon as a peculiarly severe one, on account of greater exposure of the lambs to grosser infection (due to the very restricted area of the lots) than would likely be found in practice on the farm.

From these, and our previous experiments, it cannot be definitely stated that the "bare-lot," as used by us, had any appreciable effect in preventing the lambs from obtaining stomach-worms, although, in the case where both ewes and lambs were treated, and even where the mothers, alone, received medicine, the worms were considerably fewer in number than in the control lambs. This result was evidently, largely due to the ewes being treated before being placed in the lots.

It is our opinion that no kind of lot, or corral (so-called bare-lot) where the ground-surface cannot be kept absolutely free from dust, or loose soil, and feces (droppings), will prevent lambs obtaining stomach worms in some form; that is, where the infection exists, as was the case in our experiments—the worms having passed from the ewes—as we have frequently observed the lambs nibbling and "nosing around" amongst the dust and manure, even when not a spear of grass appeared to be present.

We are inclined to the opinion, although we have not yet made the test at this Station, that one of, if not the most satisfactory manner of dealing with the stomach-worm problem would be a system of periodic rotation of the pasture or other feeding grounds, combined with suitable vermicide medicines.

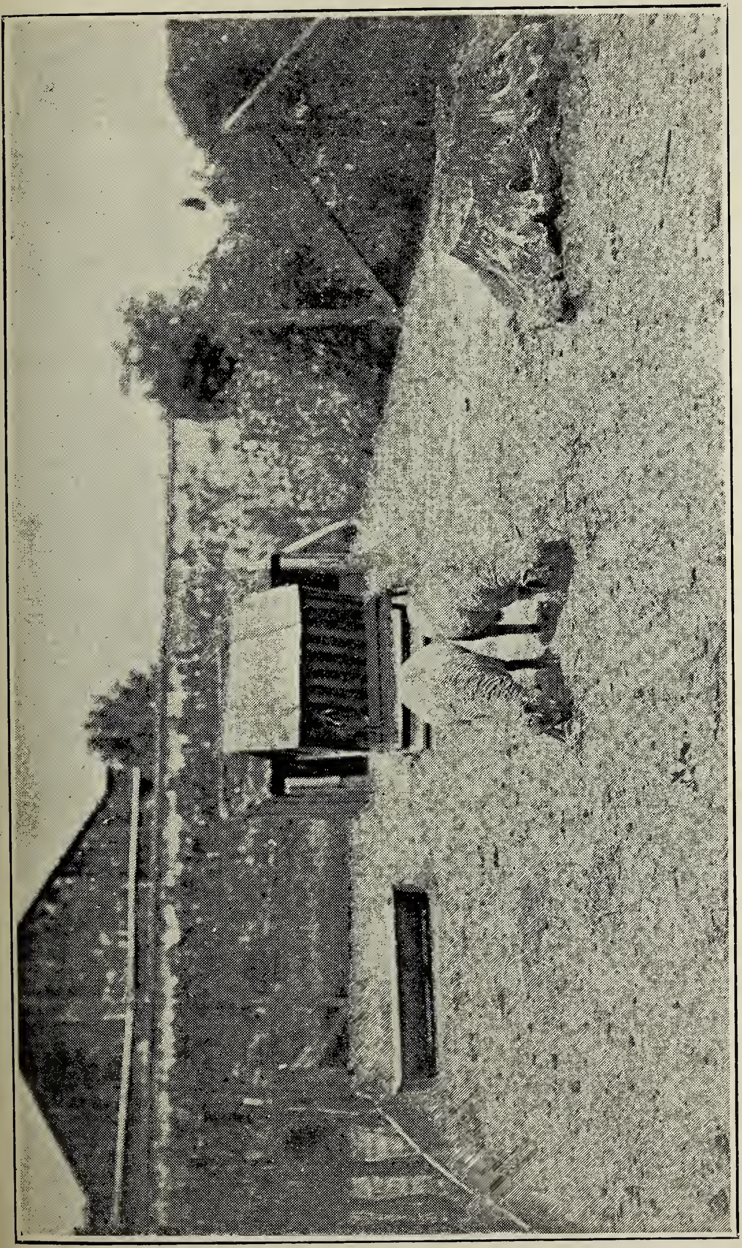
So far as we are aware, the bisulphide of carbon had not previously been employed as a vermicide in sheep; and from the use of only two doses each to two lambs, we are scarcely in a position to give a definite opinion as to its efficacy, although we are inclined to think that it gave rather better results, in our case, than the coaltar creosote, as may be seen by reference to the record of post-mortem examinations.

We believe that carbon bisulphide is worthy of further trial in practice, but we must add a word of caution. This agent is very combustible, and must be handled with great care. The better method of preparing the mixture would seem to be to first add the bisulphide to the raw linseed oil and agitate the two thoroughly. Then add the lime water and again shake the whole until thoroughly amalgamated.

After administering this mixture to the two lambs, and one or two of the ewes, it was observed to have what appeared to be a slight, temporary intoxicating effect, the animals holding their heads to one side, and in one or two cases a tendency to "buck jump," as it were. This may have been due, however, and we think it quite probable, more to the uncomfortable sensation produced in the more exposed part of the mouth and around the lips by the rapid evaporation of the bisulphide. As previously stated, the effect was only temporary, and we had no bad after-effects whatever in any of the animals so treated. This might be obviated by administering the bisulphide in a gelatine capsule, as has been done when giving this agent to dislodge "stomach bots" in horses, but we did not attempt this method in our experiments.

We are inclined to think, however, that in the case of the sheep, medicines in fluid form are more likely to sooner reach the fourth stomach than when given as a solid, which the capsule would tend to represent.

We mention this experience so that anyone trying the bisulphide-Carron-oil-mixture in practice might be prepared for the



CONTROL-LAMBS IN BARE-LOT.

effects, stated, in some of the animals. It was also observed that when the drench was well given, and none of it forced forward in the mouth by the sheep, or smeared over the outside of the mouth and lips, very little, if any, of this effect was produced; which would rather indicate that it was due to the speedy evaporation of the bisulphide from the more exposed parts alluded to.

The opinion here expressed with regard to the apparent efficacy of bisulphide of carbon is predicated solely upon our observations in these experiments, and not on its direct action upon the living parasites outside of the stomach. This we hope to take up later when an opportunity presents itself.

Neither the eight lambs nor their carcasses were weighed on this occasion, but the butcher who purchased the latter pronounced their general condition favorably comparable to, and the quality of the flesh better than, any he had handled during the season.

Louisiana Bulletin No. 96. September, 1907.

Agricultural Experiment Station

OF THE

Louisiana State University
and A. & M. College,

BATON ROUGE.

COTTON WILT,

By H. R. FULTON, M. A.

BATON ROUGE:
THE DAILY STATE, OFFICIAL JOURNAL OF LOUISIANA.
1907.

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Portion of Cotton Field Where the Loss from Wilt is About One-Fourth.

COTTON WILT.

CHARACTER AND DISTRIBUTION OF THE DISEASE.

Wilt, blackheart or black-root is a disease of cotton caused by a fungus (*Neocosmospora vasinfecta* [Atk.] Erw. Sm.) which lives in the soil of infected fields, and enters the cotton plant through one or more of its small roots. After gaining an entrance, the minute threads of the fungus grow upward in the water-carrying ducts of the plant, filling them and choking off the proper supply of water and food elements from the soil. This causes the leaves to wilt, turn yellow and drop off—one indication of the wilt disease. The fungus also produces a discoloration of the walls of the water vessels, so that the wood of the diseased plant is seen to be dark brown when the root or stem is cut across. This appearance is characteristic of this disease and gives it the names black-root and blackheart, by which it is commonly known in some localities.

The brown color of the wood serves to distinguish cotton wilt from cotton rust, an entirely different disease which is sometimes confused with the wilt. Rust is not caused primarily by any fungus, but is due to bad drainage, lack of vegetable humus in the soil, deficiency of potash, or to some other unfavorable condition of the soil.

Cotton wilt may attack a single plant here and there in a field, or the majority of the plants in a rather extensive area. The fungus spreads from root to root by the growth of its microscopic threads through the soil, where they feed upon decaying vegetable matter. Injuries to the roots of cotton, such as might be caused by deep cultivation, by the attacks of root-worms, etc., enable the fungus to make an easy entrance, and occasion a larger amount of loss from wilt than would otherwise occur. The fungus also produces in the soil, and more especially upon the dead cotton stalks, numerous spores which are microscopic in size and have an office similar to that of the seed of higher plants in multiplying and spreading the fungus, which is itself a plant of a very low order. During damp weather a pinkish coating made up of millions of these dust-like spores may be seen on the surface of dead cotton stalks; these become dry, and the wind scatters them far and wide. The spores may be easily carried on the lint and seed, and it is possible that infection may be spread to distant localities in this way, although it has not been established that this is a usual mode of transmission. The writer has made numerous attempts to secure cultures of the wilt fungus from seed taken from badly wilted plants; until now the fungus has not been obtained from this source. Artificially, the fungus may be spread by means of dirt carried from an infected field on the feet of workmen, of stock, or on farming implements.

The wilt is first noticed when the cotton is putting on the first forms. Deaths from the disease become progressively more numerous until the crop is well matured. Attacked plants at times survive for a consideralbe time, even until the end of the season, but such plants have a characteristic dwarfed growth and abnormal appearance. At times a single limb wilts and dies, while the rest of the plant keeps its normal appearance for some weeks.

Besides cotton the fungus is known to attack only one plant, okra. It certainly does not attack other common crop plants, such as corn, cowpeas, velvet beans, oats, grasses, etc. Cowpeas are, however, subject to a similar wilt disease which is caused by a fungus very closely related to the one causing cotton wilt. But the cotton fungus can not affect cowpeas, and the cowpea fungus can not affect cotton. However, it is possible for both fungi to exist side by side in a particular spot; and both cotton and cowpeas will, of course, develop wilt on such doubly infected land.

The cotton wilt fungus lives over from season to season on decaying vegetable matter in the soil; but it seems to thrive best when it can lay hold on cotton. And so, when infected land is planted successively in cotton, losses from the wilt become greater from year to year. The converse practice of keeping cotton off the land results in a diminution of loss from wilt. But the fungus is not entirely eradicated by this procedure, certainly in one instance not by a seven years' rest of the land.

Cotton wilt is known to occur in North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Arkansas, Texas and Louisiana.

Our records, which are at present necessarily very incomplete, show that the disease occurs in the following parishes in Louisiana: Caddo, Natchitoches, Rapides, Avoyelles, Pointe Coupee, Morehouse, Ouachita, Richland, Caldwell, Franklin, Catahoula, West Feliciana, East Feliciana, East Baton Rouge, and Tangipahoa. It can be safely assumed that the list is not even half complete. The disease is at its worst in the North Louisiana parishes, but the bluff lands east of the Mississippi and the Red River valley have a large amount. The fungus prefers a light sandy soil that is well drained, and its ravages may be as great in very fertile soils as in soils that are exhausted.

METHODS OF CONTROL.

The peculiar habits which the wilt fungus has of living and spreading in the soil, of entering the cotton plant through the roots, of growing well within the woody tissues of the plant, and of persisting in the soil for a seemingly indefinite period, all combine to make the wilt disease a particularly difficult one to combat by direct means. The methods which have been tried, and the degrees of success attending their use, are indicated in the following paragraphs.

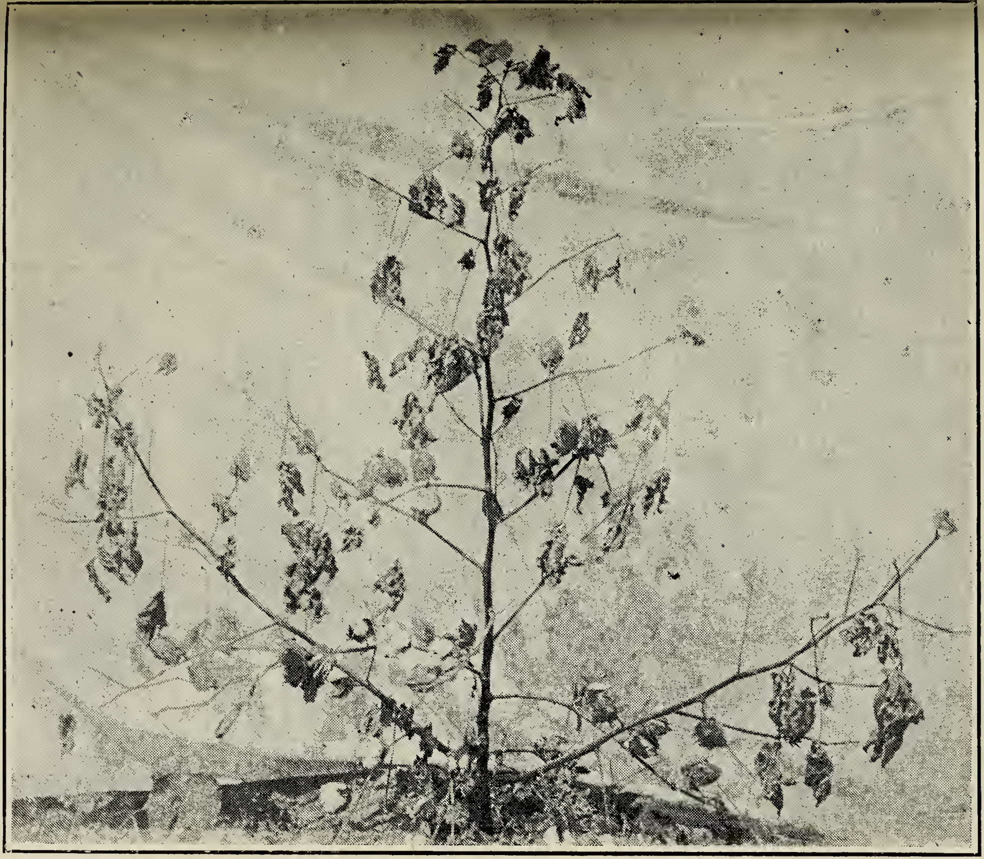
Use of Fungicides.—From what has already been said regarding the nature of the disease, and the habits of the causative organism, it could not be expected that the spraying of cotton plants with fungicides would give relief. It might be supposed, however, that fungicides applied to the soil would accomplish the destruction of the fungus. Extensive experiments in which various fungicides were used in quantities so great as to prohibit their use in farm practice, either on account of the expense, or the injurious effect on the cotton itself, have demonstrated the utter impracticability of this method. It could not be seen that any fungicide reduced the amount of wilt appreciably.

Destruction of Affected Plants.—Every affected plant is a source of infection for other plants. Especially is this true of plants dying early in the season. An inspection of any wilt-sick field will show striking instances of the spread of the disease from plant to plant in a row, and from row to row in a larger area. Moreover, left over cotton stalks, with their decaying roots all full of the wilt fungus, are the best imaginable nurseries for it during the winter. It is the part of wisdom to remove stalks completely and destroy them by burning as soon as the first signs of wilt appear. This is especially important early in the season and on lands in which the wilt is just beginning to gain a foothold; in such cases the practice is more feasible. The removal of stalks at the end of the season accomplishes a double purpose when the cotton grower is contending with wilt and weevils at the same time.

Rotation of Crops.—While the keeping of cotton off infected fields for even a long term of years does not completely stamp out the wilt disease, a rotation that rests the land from cotton has a most beneficial effect in checking the disease. The lands that have the most wilt are as a rule the ones that have been in cotton without a break for a long term of years. The usual three year rotation including oats, cowpeas, cotton, and corn and cowpeas, is an excellent one for the present purpose. If the land happens to be doubly infected with cotton wilt and cowpea wilt, cowpeas must be omitted, or the Iron cowpea, which is highly resistant to wilt, used.

A further complication may arise from the presence in sandy lands of the root-worm, which causes enlargements, known as the root-knot, on the roots of cotton, cowpeas, and a large number of other crop plants, but does not attack oats, corn, velvet-beans, or most grasses. Iron cowpeas are strongly resistant to root-knot as well as to wilt. Root-knot, like wilt, can be held in check by a rotation which brings in the susceptible crop, cotton, once in three years; and it differs from wilt in that it can be completely eradicated in a comparatively short time by keeping all susceptible plants off the land.

Manuring.—The wilt disease is not caused by soil conditions, as is rust, but by a fungus which may flourish in many types of soil varying very much in chemical composition and in physical properties. But the fungus has its preferences, as do higher plants, and is found more abundantly in light and sandy soils. The condition of the soil has another indirect bearing on the wilt problem growing out of the important part the soil plays in the production of vigorous cotton plants that can ward off disease. Along this line it has been shown that the use of stable



A COTTON STALK AFFECTED WITH THE WILT.

manure on wilt-infested land results in a very marked decrease in the loss from wilt, as well as in the increase in the productiveness of the stalks generally. In our own tests, the average loss from wilt at the present writing, on an unmanured plot, is just twice as great as on a comparable lot which has received stable manure at the rate of thirty loads per acre. Moreover, the wilt is increasing more rapidly on the former plot than on the latter, and the end of the season bids fair to show a proportion of four or five to one. The plowing under of cowpeas and other leguminous crops has a similar though less marked beneficial effect—another reason for adopting a system of rotation of crops on wilt-sick land.

Commercial fertilizers do not give the same good results; nor do they tend to increase the amount of wilt.

With reference to stable manure, the caution must be given that the wilt fungus will grow luxuriantly in a barnyard when once it has gained entrance; and infected manure may be the means of spreading the disease to a previously healthful field.

The Use of Wilt Resistant Varities of Cotton.—The various varieties of cotton are susceptible to the wilt disease in very different degrees. For instance, in tests made by Mr. W. A. Orton, of the Department of Agriculture, Jackson showed the highest resistance, 45%; Eldorado was next highest with 23%; Hawkins Prolific was 14%; Excelsior was 10%; King, 8%, and Russell, 6%. The Georgia State Board of Entomology reports among others the following: Jackson, specially selected for resistance, 82%; Red Shank, 55%; Kings Improved, 35%; Excelsior, 22%; Russell Big Boll, 10%.

It will be seen that Jackson is far in the lead among upland cottons, of which about twenty-eight were included in the two tests reported. Our this season's tests along the same line, will extend the list, without, however, revealing any variety superior to Jackson in resisting powers.

This natural resistance of Jackson cotton has been further increased by careful selection carried on since 1900 by Mr. Orton, and the improved strain is sent out as Jackson Wilt-Resistant cotton. While this cotton is not entirely immune, it is very highly resistant. Our own tests of it this season confirm the conclusion of others that it is a very useful cotton for wilt infested districts, and deserves a careful trial in such localities. The following is a brief description of the plant:

"The plant is nearly limbless, except for one or two large basal branches, erect, tall, bolls medium sized, clustered, seed small, gray. A very productive variety. The bolls open well, but hold the seed cotton firmly. For this reason it is never blown out of the boll by storms, and is also somewhat harder to pick than the big-boll varieties."

Mr. Orton has originated by selection another highly resistant cotton, to which the name Dixie has been given. In resistance and in productiveness it ranks below the Jackson. "The plant is somewhat of the Peterkin type, with numerous branches. The bolls are of medium size; color of seed variable. The variety should be further improved by selection for larger bolls and greater productiveness."

Unfortunately, neither of these most resistant varieties is sufficiently early in maturing the bolls to give promise of much usefulness in boll weevil districts. Triumph and King are both quite susceptible to wilt. The Department of Agriculture and the Louisiana Stations are giving attention to the matter of securing a resistant cotton suitable for planting in weevil infested districts.

The Louisiana Stations, through the courtesy of the Department of Agriculture, have been furnished with seed of Jackson and Dixie wilt-resistant cotton; this is being tested in a number of localities in the State this season. There will be a limited amount of seed for the same purpose next season. Interested parties may obtain further information regarding the matter by writing to the Agricultural Experiment Station, Baton Rouge.

In addition to this varietal difference in resistance to wilt, there is an individual difference in resistance apparent in any given variety. This may form the basis for obtaining, through careful selection, a strain of the particular variety which is more highly resistant than the variety generally. Something may be accomplished in this direction by simply gathering in one mixed lot seed from stalks that remain sound on wilted areas. While this is better than no selection at all, it is by no means the best method; and for the following reasons: (1) Not all stalks so remaining in a diseased area possess a high degree of inherent resistance to the wilt. Some may even have been attacked by the wilt fungus, but so slightly as not to give external evidence of their condition; others may have escaped infection by accident, and not on account of any inherent power of resistance. (2) Of those stalks possessing a high degree of resistance, some will transmit the character more completely to the next generation than others. This individual difference in transmitting power must be taken into account in all careful breeding work. To test this power it is necessary to plant the seed from each plant separately, and to compare the progeny the next season, making further selections only from those lots that show the character most uniformly.

The procedure, then, to be followed in breeding cotton for wilt resistance is about as follows: The first season selection is made in a badly wilted area of, say, ten stalks that give indications of high resistance, and are in other ways satisfactory. These stalks are conspicuously marked with white cloths, and are tagged with consecutive numbers. The cotton from each is picked in a separate bag kept for the particular stalk, and numbered to correspond with it. For planting these small lots of seed, select a piece of land large enough for the purpose and having the wilt abundantly and evenly distributed through it, as indicated by the effect on this season's crop. This may be called the "progeny plot." Thoroughly prepare the land, and plant the seed from each stalk in a single row, in hills, three or four seed to the hill, and one hundred or more hills to the row. The seed may be planted in the lint if it is only lightly covered. During this second season the amount of wilt must be noted in each row, and the row showing greatest freedom from disease marked for further selections. In this row mark, number and pick separately the ten best plants, and test these ten lots of seed the next, or third, season by the "stalk-row" method in a progeny plot. The seed from the remaining ninety or more stalks of this best row is to be gathered in one lot, ginned without mixing with other seed, and planted by ordinary methods the third season in what may be termed an "increase plot," from which seed may be had for general planting the next or fourth season. The seed from the nine rows other than the single best row of the second season is probably better than that taken indiscriminately from the field, and may be used for general planting the third season.

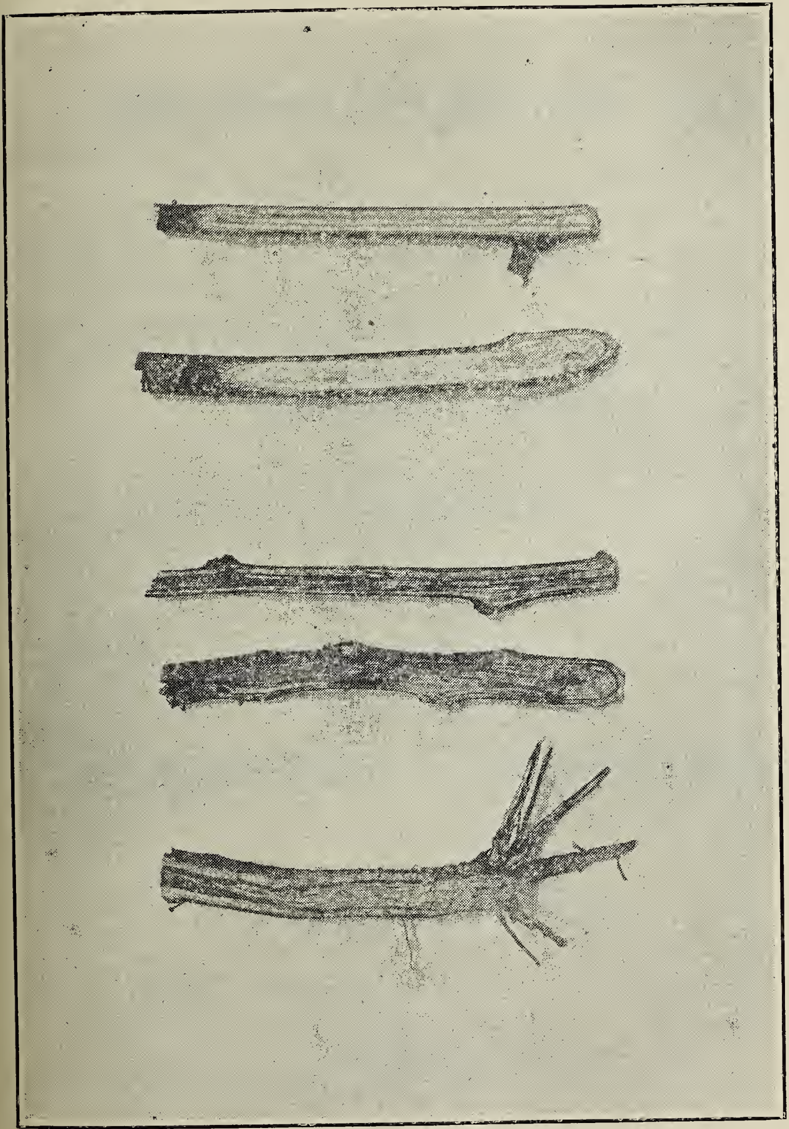
In outline form, the steps are these:

FIRST SEASON	SECOND SEASON	THIRD SEASON	FOURTH SEASON
Selection of Plants	Progeny Test	Increase Plot	General Crop
	Selection of Plants	Progeny Test	Increase Plot
		Selection of Plants	Progeny Test

This method appears somewhat complicated and slow; but the results obtained by its use make it a far better one than that of merely selecting haphazard from the general crop. The plan is one of general application in plant breeding, and has showed its worth with many crops besides cotton. It will well repay the care required in its execution.

The extensive distribution of cotton wilt in Louisiana, the increase in its destructiveness from year to year, and the impossibility of stamping it out directly, all render the wilt problem a serious one in this State. By prompt destruction of affected plants, by rotation of crops, by the use of stable manure, and by the planting of wilt-resistant varieties of cotton, the disease can be held in check.

The Louisiana Experiment Stations are conducting work along the lines of studying the life history of the wilt fungus, of introducing and testing varieties of cotton that have proved to be wilt-resistant in other States, of testing the relative resistance of good varieties of cotton, and of breeding from these with a view to obtaining strains that are both wilt-resistant and otherwise adapted to local conditions. A full report on this work will not be possible for some time. With the purpose of enlisting the interest of the cotton growers of the State in the work, this general summary of our knowledge concerning cotton wilt has been prepared.



Portions of Cotton Stalks Showing the Discoloration Produced in the Wood by the Wilt Fungus. The Two Pieces to the Right Are From a Sound Stalk.

Louisiana Bulletin No. 97. September, 1907.

Agricultural Experiment Station

OF THE

Louisiana State University and A. & M. College,

BATON ROUGE.

ANALYSES OF COMMERCIAL FERTILIZERS AND PARIS GREEN.

J. E. HALLIGAN, B. S.

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FERTILIZERS AND PARIS GREEN.

Summary of Results of Analyses of Fertilizers and Paris Green Made in the Chemical Laboratory of the State Experiment Station of the Louisiana State University and A. & M. College, Baton Rouge, Louisiana, for the year 1906-1907.

By J. E. Halligan.*

Complete fertilizers	2,164
Fertilizers containing phosphoric acid and nitrogen, not tankages	67
Fertilizers containing phosphoric acid and potash	95
Acid phosphates	486
Bone meals	206
Tankages	206
Cotton seed meals	864
Chemicals	58
Miscellaneous	15
Paris green	214
Total Analyses	4,375

For analyses of commercial feed stuffs see bulletin on this subject.

COMPLETE FERTILIZERS.

A complete fertilizer is one that contains the three essential elements: nitrogen, phosphoric acid and potash.

Many of the shipments of these fertilizers fail to come up to the guarantee in all three of the essential elements. In nearly every instance where there is a deficiency it is in the nitrogen content. When the nitrogen is below the guarantee there is generally an excess of phosphoric acid present. Some of the samples this last year showed a poor mechanical condition. The manufacturer, in most cases, evidently places enough material in the fertilizer to meet the guarantee, but owing to poor mixing the materials sometimes do not become evenly distributed, and so two samples from the same lot will not always give concordant results.

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*With the assistance of W. G. Taggart, B. S.; A. P. Kerr, B. S., and A. B. Joffrion, B. S.

Out of 2,164 samples of complete fertilizers analyzed:

9 failed to reach their guarantee in phosphoric acid and nitrogen,
19 failed to reach their guarantee in nitrogen and potash,
49 failed to reach their guarantee in phosphoric acid and potash,
229 failed to reach their guarantee in nitrogen only,
171 failed to reach their guarantee in potash only, and
76 failed to reach their guarantee in phosphoric acid only.

There were not any shipments that fell below the guarantee in all three elements.

ACID PHOSPHATES AND SUPERPHOSPHATES.

This class of fertilizers containn one valuable element namely, phosphorous.

These fertilizers are prepared by treating bone ash, bone black and phosphatic rocks with sulphuric acid to render the phosphoric acid available.

Four hundred and eighty-six samples were analyzed the past season and 452 came up to their guarantee in available phosphoric acid.

BONE MEALS.

This class of fertilizers contain nitrogen and phosphoric acid.

There were 206 shipments examined this year and 179 samples reached their guarantee in phosphoric acid and nitrogen Twenty-three samples fell below in phosphoric acid and 4 samples fell below in nitrogen. None of the samples ran below in both elements.

This class of fertilizer should be purchased on its mechanical condition as well as on its guarantee.

The phosphoric acid in bone meal is practically all insoluble and very little of it is immediately available.

TANKAGE.

Tankage is composed entirely of animal matter. It is the refuse from slaughter houses and consists of meat, bone, etc. (from which the fat has been extracted), and more or less dried blood.

A great many tankages failed to reach their guarantees. Out of 206 samples analyzed 18 samples were below the guarantee in ammonia and phosphoric acid, 92 samples below in ammonia only, and 8 samples below in phosphoric acid only—showing that there is a tendency for this class of goods to run below the guarantee in ammonia.

The phosphoric acid in tankage is slowly available as it is supplied principally by ground bone.

The ammonia is derived principally from meat and blood. When the percentage of bone is large the phosphoric acid is high and the ammonia content low and when there is an excess of blood and meat the ammonia is high and the phosphoric acid low.

There were a few samples of tankage which had hair present.

All tankages are analyzed separately and given immediate attention on their receipt at this laboratory, as settlement between the seller and purchaser is frequently made on the result of our analyses.

COTTON SEED MEAL.

The Inter-State Cotton Seed Crushers' Association at its meeting at Jamestown May 21-23, 1907, adopted the following as a standard classification for cotton seed meal:

Choice Cotton Seed Meal must contain by analysis 8 per cent Ammonia.

Prime Cotton Seed Meal must contain by analysis 7 1-2 per cent Ammonia.

Good Cotton Seed Meal must contain by analysis 7 per cent Ammonia.

Off Cotton Seed Meal: any Cotton Seed Meal which is deficient in texture, color, odor, and analysis.

We are often asked to explain how to arrive at the ammonia content when the percentage of nitrogen is given, and vice versa.

To convert Nitrogen into Ammonia multiply by the factor 1.215 and to convert Ammonia into Nitrogen multiply by the factor 0.823.

Example: A meal contains 6.59 per cent nitrogen. Its equivalent in Ammonia is 8.00 per cent, since 6.59x1.215=8.00. A meal is guaranteed 7.50 per cent Ammonia. Its equivalent in Nitrogen is 6.17 per cent, since 7.50x0.823=6.17.

The purchaser should demand a guarantee and buy accordingly. Avoid meal that has a great deal of lint and hulls present. The color of a meal is not always an indication of its Ammonia content, as some of the lighter colored meals carry a high content of hulls and adhering lint.

A great deal of cotton seed meal was used this past season for fertilizing purposes. 864 samples were examined and 230 samples fell below their guarantees. Last season 328 meals were analyzed, showing an increase of 536 shipments for this year.

MARKET VALUE OF FERTILIZER INGREDIENTS.

The quotations cited in the following table are on the principal raw materials used in the manufacture of commercial fertilizers. These quotations are f. o. b. New Orleans:

Acid Phosphate, 14 per cent available	$14.50	per	2,000	lbs.
Tennessee Phosphate Rock, 75 per cent bone phosphate of lime	7.53	”	”	”
German Kainit, 12 per cent Potash	8.25	”	”	”
Muriate of Potash	39.00	”	”	”
Sulphate of Potash	42.50	”	”	”
Nitrate of Soda	49.00	”	”	”
Sulphate of Ammonia	63.00	”	”	”
Raw Bone Meal	26.00	”	”	”
Cotton Seed Meal	25.00	”	”	”

Pyrites, 13½ to 14 cents per unit of sulphur.

Dried Blood, $3.00 to $3.15 per unit of ammonia.

Tankage, $3.00 per unit of ammonia; 10 cents per unit of bone phosphate of lime.

The prices quoted on tankage are those given by Swift & Co. Other manufacturers were consulted, but no satisfactory information was received. The valuations given on tankage in this bulletin are figured on this company's quotations f. o. b. New Orleans. The values on cotton seed meal were taken from the ruling prices for the year. All other values were obtained from the Standard Guano & Chemical Company of New Orleans, La.

VALUATION OF FERTILIZERS.

From the above quotations we arrive at the following trade values which are employed in calculating the comparative prices per ton as given in this bulletin.

In tankage the phosphoric acid is valued at 21.8 cents per unit and the ammonia at $3.00 per unit.

The phosphoric acid in bone meal is valued at 80 cents per unit and the nitrogen at $3.40 per unit.

Cotton seed meals are valued by multiplying the nitrogen content by $3.20, which is taken as the unit value for nitrogen; $3.40 is added to this result to cover the value of the phosphoric acid and potash present in cotton seed meal.

In all other fertilizers the following values are used:

Available phosphoric acid	$1.00	per unit
Potash	0.80	”
Nitrogen	3.20	”

A unit is equal to 20 pounds, or one per cent of a ton.

A fertilizer guaranteed 10 per cent available phosphoric acid, 1.50 per cent potash and 2.47 per cent nitrogen is worth, according to these values, $19.10 per ton, since:

10.00 per cent available phosphoric acid at $1.00 per unit equals	$10.00
1.50 per cent potash at $0.80 per unit equals	1.20
2.47 per cent nitrogen at $3.20 per unit equals	7.90
Ton value	$19.10

The prices given in this bulletin represent the wholesale cost of fertilizers, and they are given so as to enable the purchaser to arrive at some conclusion concerning the value of his fertilizer. The freight, cost of inspection, cost of mixing, cost of sacks, storage, dealer's profit, and manufacturer's profit are not considered.

Analyses and Approximate Relative Valuation of Fertilizers Louisiana State University and A.

NAME OF BRAND	NITROGEN in pounds		TOTAL PHOSPHORIC ACID in pounds	
	Amount	Value at 16c per pound	Amount	Value at 4½c per pound
High Grade Acid Phos.	.....	.....	.....	.....
Acid Phosphate	.....	.....	.....	....
High Grade C. S. Meal	7.48	$1.20	.....	.....
Medium C. S. Meal	6.58	1.05	.....	.....
Low Grade C. S. Meal	5.53	.88	.....	.....
Kainit	.....	.....	.....	.....
High Grade Tankage	9.39	1.50	9.68	$0.44
Medium Grade Tankage	6.00	.96	8.00	.36
Low Grade Tankage	4.57	.73	.....	...
Ground Bone	2.50	.40	20.00	.90
Fish Scraps	10.00	1.60	7.00	.31
Dried Blood	13.00	2.08	.....	.....
Am. Sulphate	20.00	3.20	.....	.....
Nitrate Soda	16.00	2.56	.....	.....
Sulph. Potash	.....	.....	.....	.....
Muriate Potash	.....	.....	.....	.....

Made at the Chemical Laboratory of Experiment Stations of the & M. College, Baton Rouge, La.

AVAILABLE PHOSPHORIC ACID in pounds		POTASH in pounds		TOTAL VALUE Per	
Amount	Value at 5c per pound	Amount	Value at 4c per pound	100 pounds	Ton
16.00	$0.80	.....	.....	$0.80	$16.00
14.00	.70	.....	.....	.70	14.00
.....	.....	.....	.....	1.20	24.00
.....	.....	.....	.....	1.05	21.00
.....	.....	.....	.....	.88	17.60
.....	.....	12.34	$0.49	.49	9.86
.....	.....	.....	.....	1.94	38.80
.....	.....	.....	.....	1.32	26.40
8.00	.40	.....	.....	1.13	22.60
.....	.....	.....	.....	1.30	26.00
.....	.....	.....	.....	1.91	38.20
.....	.....	.....	.....	2.08	41.60
.....	.....	.....	.....	3.20	64.00
.....	.....	.....	.....	2.56	51.20
.....	.....	50.00	2.00	2.00	40.00
.....	.....	50.00	2.00	2.00	40.00

FILLERS.

A filler is any substance in a fertilizer besides the nitrogen, phosphoric acid, or potash. In the general meaning of the term, a filler is spoken of as something added to a fertilizer to make weight.

The principal substances used for fillers are gypsum, sand, marl, pyrites cinders, powdered cinders, etc. The following example will illustrate an instance where the manufacturer would use a filler.

Suppose a manufacturer wants to make a fertilizer guaranteed to contain 8 per cent available phosphoric acid, 1.65 per cent nitrogen, which is equivalent to 2 per cent ammonia, and 2 per cent potash. He has on hand acid phosphate containing 14 per cent available phosphoric acid, nitrate of soda containing 15.50 per cent nitrogen, and muriate of potash containing 50 per cent potash. Since 8 per cent available phosphoric acid is equal to 8 pounds of phosphoric acid to every 100 pounds of fertilizer, in 2000 pounds he has 8x20 or (160) pounds of available phosphoric acid. In the same way he finds that he must have 33 pounds of nitrogen and 40 pounds of potash. By the following proportion the manufacturer finds the number of pounds of acid phosphate, nitrate of soda, and muriate of potash he will have to use to make 8-2-2 fertilizer:

14 :100 : :160 :number of pounds of acid phosphate required.
15 1-2 :100 : :33 :number of pounds of nitrate of soda required.
50 :100 : :40 :number of pounds of muriate of potash required.

That is,

1,143 pounds of acid phosphate containing 14 per cent available phosphoric acid,
213 pounds of nitrate of soda containing 15.5 per cent nitrogen
80 pounds of muriate of potash containing 50 per cent potash,

Total. . .1,436 pounds.

The manufacturer must add 564 pounds of filler, in the form of cinders or whatever he has on hand, to make 2,000 pounds and meet the guarantee of 8-2-2. The manufacturer generally adds a slight excess of each of these fertilizing ingredients in making his goods, to make sure that his goods will reach the guarantee.

In many of the fertilizers sold in Louisiana there are no make-weight substances added. These fertilizers are composited from mixtures of Kainit, Cotton Seed Meal, Acid Phosphate, Tankage, Bone Meal, etc. The following example will illustrate this point.

As in the case above, a manufacturer wishes to make a fertilizer containing 8 per cent available phosphoric acid, 1.65 per cent nitrogen, equivalent to 2 per cent ammonia, and 2 per cent potash. He has on hand acid phosphate containing 14.5 per cent available phosphoric acid, cotton seed meal containing 6.2 per cent nitrogen, 1.5 per cent potash and 2.5 per cent phosphoric acid and kainit containing 12 per cent potash. He figures:

550 pounds of cotton seed meal*
340 pounds of kainit
1,110 pounds of acid phosphate

Total, 2,000 pounds.

In this mixture there are no filler substances added.

*The cotton seed meal furnishes 13 pounds of phosphoric acid and 8 pounds of potash.

PARIS GREEN.

Paris Green is composed of arsenious oxide, copper oxide, and acetic acid, combined in the form of copper aceto-arsenite. Theoretically, the composition of Paris Green is as follows:

Arsenious oxide	58.65 per cent
Copper oxide	31.29 " "
Acetic acid	10.06 " "

The Paris Green put on the market is not chemically pure and impurities such as sodium sulphate, sand, and uncombined arsenious oxide are generally present in small amounts. Barium sulphate and calcium carbonate are sometimes used as adulterants.

Sometimes Paris Green scorches or scalds the foliage. This scorching is due to the presence of free or uncombined arsenious oxide, which is uncombined with the copper. When Paris Green is poorly manufactured the rain and the dew are apt to decompose it rapidly and arsenious oxide is set free, causing scorching. Of course, the rain and the dew decompose pure Paris Green, but not enough to cause serious results.

When Paris Green is used for spraying purposes it is good practice to add lime because lime neutralizes any free arsenious oxide that may be present, and thus prevents scorching to a certain extent.

SUMMARY.

The arsenious oxide in pure Paris Green should be combined with the copper. Good Paris Green should be finely ground to allow of an even distribution, and it should not contain over 4 per cent of uncombined arsenious oxide.

The past season 214 samples of Paris Green were analyzed and all of them ran above the guarantee of 50 per cent arsenious oxide as required by our law. These samples varied in arsenious oxide from 52.43 per cent to 58.08 per cent, and they averaged 57.17 per cent.

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Arcadia Cotton Oil Mill & Manufacturing Co.,			
Arcadia, La.,			
Cotton Fertilizer	1505	5	5.90
	1751	4	9.20
	2186	1	7.85
Average		10	7.65
Corn Fertilizer	1633	2	6.43
	2187	1	6.65
Average		3	6.54
Arkansas Fertilizer Co.,			
Little Rock, Ark.			
White Diamond Ammoniated Bone Superphosphate	1753	2	6.33
White Diamond 20th Century Fertilizer	1752	3	7.10
	1596	5	4.85
Average		8	5.98
Caddo Fertilizer Co.,			
Shreveport, La.			
Caddo Cotton	1348	10	6.10
	1444	2	5.83
	1492	15	5.40
	1988	6	6.95
	1838	3	6.55
	1232	2	6.28
	1584	9	6.18
	1693	4	6.35
	1898	25	7.45
	2054	7	6.98
	2191	2	4.19
Average		85	6.21
Caddo Corn	1263	1	3.35
	1506	7	4.90
	1837	3	5.48
	1946	4	5.33
	2055	3	5.25
	1342	3	4.50
	1443	2	5.63
Average		23	4.92

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
4.35	0.55	10.80	10.25	10.00	2.01	1.75	2.44	1.62	0.50	....	....
4.22	1.66	15.08	13.42	10.00	1.75	1.75	2.12	0.20	0.50	....	....
2.54	1.36	11.75	10.39	10.00	1.38	1.75	1.68	1.61	0.50	....	....
3.70	1.19	12.54	11.35	10.00	1.71	1.75	2.08	1.14	0.50	$17.73	$16.00
3.54	0.48	10.45	9.97	8.00	3.18	3.00	3.86	1.55	1.00	....	....
1.77	0.81	9.23	8.42	8.00	2.38	3.00	2.89	2.37	1.00	....	....
2.66	0.65	9.84	9.20	8.00	2.78	3.00	3.38	1.96	1.00	$19.66	$18.40
3.62	4.00	13.95	9.95	9.50	1.36	1.65	1.65	2.08	2.00	$15.97	$16.38
7.07	0.33	14.50	14.17	9.50	2.44	1.65	2.96	2.04	2.00	....	....
4.96	4.32	14.13	9.81	9.50	1.53	1.65	1.86	2.21	2.00	....	....
6.02	2.33	14.32	11.99	9.50	1.99	1.65	2.41	2.13	2.00	$20.06	$16.38
2.36	1.72	10.18	8.46	8.00	2.16	2.05	2.62	2.10	1.00	....	....
3.65	0.40	9.88	9.48	8.00	2.79	2.05	3.39	1.73	1.00	....	....
3.20	0.55	9.15	8.60	8.00	2.26	2.05	2.75	1.65	1.00	....	....
2.48	1.25	10.68	9.43	8.00	2.20	2.05	2.66	1.98	1.00	....	....
2.87	0.76	10.18	9.42	8.00	2.08	2.05	2.53	1.28	1.00	....	....
2.77	0.90	9.95	9.05	8.00	2.14	2.05	2.60	1.66	1.00	....	....
3.64	1.21	11.03	9.82	8.00	2.01	2.05	2.44	1.57	1.00	....	....
3.86	0.72	10.93	10.21	8.00	1.91	2.05	2.32	1.00	1.00	....	....
2.98	1.25	11.68	10.43	8.00	1.82	2.05	2.21	1.10	1.00	....	....
3.34	1.16	11.48	10.32	8.00	1.65	2.05	2.00	1.10	1.00	....	....
3.56	0.80	8.55	7.75	8.00	2.50	2.05	3.04	1.18	1.00	....	....
3.16	0.97	10.33	9.36	8.00	2.14	2.05	2.60	1.49	1.00	$17.40	$15.36
3.45	0.55	7.35	6.80	6.00	3.38	2.90	4.10	1.98	1.00	....	....
4.40	0.33	9.63	9 30	6.00	2.93	2.90	3.56	1.62	1.00	....	....
3.19	0.96	9.63	8.67	6.00	2.95	2.90	3.58	1.16	1.00	....	....
2.85	0.80	8.98	8.18	6.00	3.01	2.90	3.66	1.42	1.00	....	....
3.26	0.74	9.25	8.51	6.00	3.16	2.90	3.84	1.14	1.00	....	....
3.85	0.80	9.15	8.35	6.00	2.80	2.90	3.40	1.95	1.00	....	....
4.03	0.47	10.13	9.66	6.00	2.13	2.90	2.59	1.65	1.00	....	....
3.58	0.66	9.16	8.50	6.00	2.91	2.90	3.53	1.56	1.00	$19.06	$16.08

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Caddo Fertilizer Co.—Continued.			
Caddo Special	1797	5	5.65
	1979	1	4.80
Average		6	5.23
Star	1510	5	6.78
	1692	3	7.95
	1849	1	8.58
	1896	6	7.63
	2114	1	7.45
	2184	1	4.65
Average		17	7.17
Caddo Vegetable	1798	2	5.50
	1996	2	5.83
Average		4	5.67
Capital Fertilizer and Manufacturing Co., Jackson, Miss.			
Cotton Elevator	1590	3	5.63
	1963	2	6.73
Average		5	6.18
Nonpariel	1458	2	7.23
	1519	4	6.40
	1344	2	5.20
	1673	9	7.20
	1945	4	7.95
Average		21	6.80
Red Star	1504	3	7.00
	1766	4	6.80
	2110	1	6.35
	1947	2	7.90
Average		10	7.01

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
2.43	0.75	8.83	8.08	6.00	2.53	2.50	3.07	5.16	7.00	....	....
1.74	0.91	7.45	6.54	6.00	1.95	2.50	2.37	4.94	7.00	....	....
2.09	0.83	8.14	7.31	6.00	2.24	2.50	2.72	5.05	7.00	$18.52	$19.60
4.57	0.75	12.10	11.35	10.00	1.65	1.65	2.00	1.84	1.50	....	....
4.32	0.98	13.25	12.27	10.00	1.69	1.65	2.05	1.76	1.50	....	....
3.22	1.90	13.70	11.80	10.00	1.66	1.65	2.01	1.50	1.50	....	....
3.35	1.27	12.25	10.98	10.00	1.65	1.65	2.00	0.90	1.50	....	....
4.17	1.06	12.68	11.62	10.00	1.46	1.65	1.77	1.92	1.50	....	....
3.08	0.90	8.63	7.73	10.00	1.32	1.65	1.60	2.35	1.50	....	....
3.79	1.14	12.10	10.96	10.00	1.57	1.65	1.91	1.71	1.50	$17.35	$16.48
3.07	0.81	9.38	8.57	8.00	3.30	3.30	4.01	4.80	4.00	....	....
2.59	0.88	9.30	8.42	8.00	3.03	3.30	3.68	4.58	4.00	....	....
2.83	0.85	9.34	8.50	8.00	3.17	3.30	3.85	4.69	4.00	$22.39	$21.76
3.20	0.37	9.20	8.83	8.00	1.97	1.65	2.39	3.07	2.00	....	....
2.51	1.21	10.45	9.24	8.00	1.95	1.65	2.37	1.50	2.00	....	....
2.86	0.79	9.83	9.04	8.00	1.96	1.65	2.38	2.29	2.00	$17.14	$14.88
3.17	0.00	10.40	10.40	8.00	1.65	1.65	2.00	2.42	2.00	....	....
3.25	0.33	9.98	9.65	8.00	1.83	1.65	2.22	2.32	2.00	....	....
3.76	0.82	9.78	8.96	8.00	1.38	1.65	1.68	3.34	2.00	....	....
3.46	0.92	11.58	10.66	8.00	2.17	1.65	2.63	1.54	2.00	....	....
2.08	1.22	11.25	10.03	8.00	1.56	1.65	1.89	2.00	2.00	....	....
3.14	0.66	10.60	9.94	8.00	1.72	1.65	2.08	2.32	2.00	$17.30	$14.88
3.70	0.20	10.90	10.70	8.00	1.65	1.65	2.00	2.51	2.00	....	....
4.01	0.87	11.68	10.81	8.00	1.67	1.65	2.03	2.00	2.00	....	....
2.09	0.61	9.05	8.44	8.00	2.24	1.65	2.72	2.75	2.00	....	....
1.56	0.42	9.88	9.46	8.00	1.60	1.65	1.93	2.44	2.00	....	....
2.84	0.53	10.38	9.85	8.00	1.79	1.65	2.17	2.43	2.00	$17.52	$14.88

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Clinton Cotton Oil Co.,			
Clinton, La.			
Cotton Fertilizer	1457	1	6.00
	1520	6	6.60
	1683	8	6.83
	1987	4	6.93
	2156	1	6.05
	2188	1	7.35
	1907	5	7.43
Average		26	6.74
Stanley & Gore's Choice Fertilizer	2102	1	6.98
The Coe-Mortimer Co.,			
Charleston, S. C.			
Peruvian Guano, Ex-Condor No. 2 Lobas	1468	1	3.00
Peruvian Guano, Ex-Condor No. 2 Chinca	1469	1	3.75
Federal Chemical Co.,			
Nashville, Tenn.			
Daybreak Fertilizer	2104	1	7.45
Gulfport Cotton Oil Fertilizer & Mfg. Co.,			
Gulfport, Miss.			
Standard Primo Cotton Seed Meal Compound.	1441	2	7.03
	1518	6	6.58
	1964	7	8.30
	1991	1	5.75
	2177	1	6.70
	1723	2	5.90
Average		19	6.81

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
Reverted Found %	Insoluble Found %	Total Found %	Available								
			Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
3.39	0.81	10.20	9.39	8.00	2.16	1.65	2.63	2.00	2.00	....	....
2.21	0.72	9.53	8.81	8.00	2.00	1.65	2.43	2.00	2.00	....	....
2.36	0.76	9.95	9.19	8.00	1.76	1.65	2.14	2.00	2.00	....	....
2.87	1.15	10.95	9.80	8.00	1.65	1.65	2.00	2.34	2.00	....	....
2.28	0.87	9.20	8.33	8.00	1.65	1.65	2.00	2.00	2.00	....	....
2.13	1.57	11.05	9.48	8.00	1.93	1.65	2.35	2.60	2.00	....	....
1.10	0.55	9.08	8.53	8.00	1.54	1.65	1.89	2.02	2.00	....	....
2.33	0.92	9.99	9.08	8.00	1.81	1.65	2.21	2.14	2.00	$16.58	$14.88
2.58	1.27	10.83	9.56	8.00	1.72	1.65	2.09	2.74	2.00	$17.25	$14.88
9.79	10.16	22.95	12.79	15.00	3.14	3.28	3.81	2.87	2.75	$25.14	$27.70
5.23	1.45	10.43	8.98	9.00	7.18	7.77	8.73	2.74	2.00	$34.15	$35.46
2.49	1.81	11.75	9.94	8.00	1.92	1.65	2.33	3.26	2.00	$18.69	$14.88
2.89	0.63	11.15	10.52	9.00	1.66	1.65	2.02	2.36	2.00	....	....
2.82	0.65	10.05	9.40	9.00	1.75	1.65	2.12	2.42	2.00	....	....
2.17	0.91	11.38	10.47	9.00	1.68	1.65	2.04	2.16	2.00	....	....
2.33	1.10	9.18	8.08	9.00	2.11	1.65	2.55	2.38	2.00	....	....
2.58	0.47	9.75	9.28	9.00	1.86	1.65	2.26	2.51	2.00	....	....
2.08	1.00	8.98	7.98	9.00	1.65	1.65	2.00	2.00	2.00	....	....
2.48	0.79	10.08	9.26	9.00	1.79	1.65	2.17	2.31	2.00	$16.84	$15.88

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Gulfport Cotton Oil Fertilizer & Mfg. Co.—Cont.			
Primo High Grade Blood and Bone	1452	2	7.60
	1760	2	8.18
	1977	1	10.25
Average		5	8.68
Primo Standard Cotton and Corn Guano	1968	2	7.88
	2132	1	8.88
Average		3	8.38
Standard Primo Raw Bone Superphosphate	1438	2	6.70
	1756	4	8.63
	1513	8	6.78
	1920	9	7.70
	2131	1	9.15
Average		24	7.79
Primo High Grade Vegetable Grower	1762	2	6.05
Hazlehurst Oil Mill and Fertilizer Co., Hazlehurst, Miss.			
Imperial	1096	11	8.55
	1228	3	8.40
	1347	7	7.35
	1403	11	7 40
	1508	10	8.10
	1731	12	8.25
	1865	2	7.53
	2058	2	7.83
	2193	3	8.20
	1149	3	7.85
	1843	4	8.58
Average		68	8.01
Imperial Vegetable Grower	1761	2	6.73
	1074	2	6.40
Average		4	6.57

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
4.05	1.20	12.85	11.65	10.00	2.11	1.65	2.56	2.37	2.00	....	....
2.32	0.50	11.00	10.50	10.00	1.97	1.65	2.39	2.18	2.00	....	....
2.46	1.04	13.75	12.71	10.00	2.32	1.65	2.82	2.00	2.00	....	....
2.94	0.91	12.53	11.62	10.00	2.13	1.65	2.59	2.18	2.00	$20.18	$16.88
1.67	0.55	10.10	9.55	8.00	2.15	1.65	2.61	2.22	2.00	....	....
1.63	0.64	11.15	10.51	8.00	2.73	1.65	3.32	2.40	2.00	....	....
1.65	0.60	10.63	10.03	8.00	2.44	1.65	2.97	2.31	2.00	$19.69	$14.88
3.28	1.37	11.35	9.98	9.00	2.13	1.65	2.59	2.52	2.00	....	....
3.02	1.00	12.65	11.65	9.00	2.42	1.65	2.94	2.26	2.00	....	....
2.97	0.93	10.68	9.75	9.00	2.18	1.65	2.65	2.35	2.00	....	....
2.01	0.87	10.58	9.71	9.00	2.12	1.65	2.57	2.24	2.00	....	....
2.07	0.51	11.73	11.22	9.00	2.46	1.65	2.99	2.09	2.00	....	....
2.67	0.94	11.40	10.46	9.00	2.26	1.65	2.75	2.29	2.00	$19.52	$15.88
2.10	0.35	8.50	8.15	6.00	3.40	3.00	4.13	5.92	5.00	$23.77	$19.60
3.31	0.89	12.75	11.86	9.50	1.72	1.65	2.09	2.26	1.75	....	....
2.87	1.26	12.53	11.27	9.50	1.65	1.65	2.00	2.27	1.75	....	....
3.40	0.45	11.20	10.75	9.50	1.84	1.65	2.23	2.65	1.75	....	....
3.19	1.06	11.65	10.59	9.50	1.69	1.65	2.05	2.54	1.75	....	....
2.96	0.52	11.58	11.06	9.50	1.65	1.65	2.00	2.18	1.75	....	....
2.86	1.27	12.38	11.11	9.50	1.73	1.65	2.10	1.76	1.75	....	....
2.56	0.54	10.63	10.09	9.50	1.88	1.65	2.28	2.08	1.75	....	....
2.65	1.07	11.55	10.48	9.50	2.06	1.65	2.50	1.90	1.75	....	....
2.66	0.97	11.83	10.86	9.50	1.94	1.65	2.36	2.18	1.75	....	....
2.79	0.67	11.31	10.64	9.50	1.51	1.65	1.83	2.42	1.75	....	....
1.31	2.31	12.20	9.89	9.50	1.56	1.65	1.89	1.86	1.75	....	....
2.77	1.00	11.78	10.78	9.50	1.75	1.65	2.12	2.19	1.75	$18.13	$16.18
1.90	0.22	8.85	8.63	6.50	3.38	2.00	4.10	3.00	3.00	....	....
4.91	0.22	11.53	11.31	6.50	1.56	2.00	1.89	1.32	3.00	....	....
3.46	0.22	10.19	9.97	6.50	2.97	2.00	3.00	2.16	3.00	$21.20	$15.30

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Homer Cotton Oil Co.,			
Homer, La.			
Claiborne Mixture No. 1	1594	6	7.48
	1687	4	8.23
	1974	1	9.38
Average		11	8.36
Jackson Fertilizer Co.,			
Jackson, Miss.			
Chicago Raw Bone Superphosphate	1631	1	6.15
Fruit and Vegetable	1450	2	5.23
	1958	2	6.00
Average		4	5.62
Lampton's Raw Bone Superphosphate	1632	1	6.65
	1224	1	7.80
	1980	1	8.30
Average		3	7.58
Royal C Brand	1360	5	7.68
	1449	2	7.33
	1738	5	8.75
	2027	1	8.55
	2105	2	8.05
	2190	1	7.98
	1634	5	8.15
	1841	4	8.80
	1206	2	5.35
	2133	1	6.58
Average		28	7.72
Meridian Fertilizer Factory,			
Meridian, Miss.			
Meridian Blood and Bone	1635	3	8.55
	1975	3	7.08
Average		6	7.82

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
3.92	0.30	11.70	11.40	10.00	2.59	1.75	3.14	1.03	0.50	....	....
4.30	0.65	13.18	12.53	10.00	2.51	1.75	3.05	0.58	0.50	....	....
2.80	1.15	13.33	12.18	10.00	1.96	1.75	2.38	0.50	0.50	....	....
3.67	0.70	12.74	12.04	10.00	2.35	1.75	2.86	0.70	0.50	$20.12	$16.00
3.96	3.27	13.38	10.11	9.50	1.84	1.65	2.23	2.16	1.50	$17.73	$15.98
1.97	0.73	7.93	7.20	6.00	3.30	3.00	4.01	4.41	4.00	....	....
2.12	0.88	9.00	8.12	6.00	3.17	3.00	3.86	4.04	4.00	....	....
2.05	0.81	8.47	7.66	6.00	3.24	3.00	3.94	4.23	4.00	$21.41	$18.80
4.48	3.82	14.95	11.13	9.50	1.83	1.65	2.22	1.58	1.50	....	....
4.94	1.46	14.20	12.74	9.50	1.48	1.65	1.80	1.62	1.50	....	....
5.13	2.07	15.50	13.43	9.50	1.29	1.65	1.57	1.74	1.50	....	....
4.85	2.45	14.88	12.43	9.50	1.53	1.65	1.86	1.65	1.50	$18.65	$15.98
3.20	1.42	12.30	10.88	9.50	1.83	1.65	2.23	1.91	1.80	....	....
3.40	1.42	12.15	9.73	9.50	1.76	1.65	2.14	2.24	1.80	....	....
2.17	1.76	12.68	10.92	9.50	1.65	1.65	2.00	1.84	1.80	....	....
2.83	1.30	12.68	11.38	9.50	1.66	1.65	2.01	1.98	1.80	....	....
2.01	0.99	11.05	10.06	9.50	1.65	1.65	2.00	3.15	1.80	....	....
2.87	1.00	11.85	10.85	9.50	1.65	1.65	2.00	2.11	1.80	....	....
4.42	1.36	13.93	12.57	9.50	1.57	1.65	1.91	2.10	1.80	....	....
3.24	1.16	13.20	12.04	9.50	1.58	1.65	1.92	1.96	1.80	....	....
6.00	1.30	12.65	11.35	9.50	1.58	1.65	1.92	2.25	1.80	....	....
3.58	1.79	11.95	10.16	9.50	1.50	1.65	1.82	2.45	1.80	....	....
3.37	1.35	12.44	10.99	9.50	1.64	1.65	2.00	2.20	1.80	$18.00	$16.22
3.13	0.42	12.10	11.68	9.50	1.81	1.65	2.20	1.70	1.50	....	....
2.65	2.42	12.15	9.73	9.50	2.06	1.65	2.50	1.54	1.50	....	....
2.89	1.42	12.13	10.71	9.50	1.94	1.65	2.35	1.62	1.50	$18.21	$15.98

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Meridian Fertilizer Factory.—Continued.			
Meridian Home Mixture	1313	2	7.88
	1512	25	6.83
	1672	28	7.83
	1805	7	7.93
	1908	3	8.00
Average		65	7.69
Meridian Soluble Guano	1361	2	8.45
	2025	1	7.85
	2108	1	7.55
Average		4	7.95
Meridian Vegetable Grower	2107	1	6.43
Minden Cotton Oil & Ice Co., Minden, La.			
North Louisiana Standard	1345	5	8.73
	1688	6	9.63
	1904	7	9.50
	2130	1	8.20
Average		19	9.02
The Mississippi Fertilizer Co., Jackson, Miss.			
Standard Horseshoe Brand Fertilizer	1223	1	9.35
	1749	1	9.70
Average		2	9.53

FERTILIZERS.

PHOSPHORIC ACID			Available		Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
1.98	1.12	10.98	9.86	9.50	1.90	.65	2.30	1.97	1.50	....	....
3.67	1.20	11.70	10.50	9.50	1.73	1.65	2.10	1.82	1.50	....	....
3.44	1.31	12.58	11.27	9.50	1.74	1.65	2.12	1.89	1.50	....	....
2.63	1.69	12.25	10.56	9.50	1.86	1.65	2.26	1.64	1.50	....	......
4.05	1.05	13.10	12.05	9.50	1.53	1.65	1.86	1.96	1.50	....	....
3.15	1.27	12.12	10.85	9.50	1.75	1.65	2.13	1.86	1.50	$17.94	$15.98
2.42	1.06	11.93	10.87	9.50	2.37	1.65	2.87	1.70	1.50	....	....
4.20	0.43	12.48	12.05	9.50	1.91	1.65	2.32	2.02	1.50	....	....
2.60	1.32	11.47	10.15	9.50	1.80	1.65	2.18	2.56	1.50	....	....
3.07	0.94	11.96	11.02	9.50	2.03	1.65	2.46	2.09	1.50	$19.19	$15.98
2.96	0.76	10.15	9.39	6.00	2.97	2.50	3.60	4.12	5.00	$22.19	$18.00
2.90	1.00	12.63	11.63	10.00	2.01	1.75	2.44	0.81	0.50	....	....
3.00	1.30	13.93	12.63	10.00	2.09	1.75	2.54	0.50	0.50	....	....
3.19	1.31	14.00	12.69	10.00	1.67	1.75	2.03	0.50	0.50	....	....
3.86	1.37	13.43	12.06	10.00	1.61	1.75	1.96	0.54	0.50	....	....
3.24	1.25	13.50	12.25	10.00	1.85	1.75	2.24	0.59	0.50	$18.64	$16.00
1.73	1.75	12.83	11.08	9.50	1.67	1.65	2.03	2.31	1.80	....	....
3.42	0.68	13.80	13.12	9.50	1.75	1.65	2.12	2.72	1.80	....	....
2.58	1.22	13.32	12.10	9.50	1.71	1.65	2.08	2.52	1.80	$19.59	$16.22

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
New Orleans Acid & Fertilizer Co., Gretna, La.			
Ammoniated Raw Bone Superphosphate and Potash	1209	6	6.80
	1302	3	7.38
	1451	2	7.95
	1515	8	7.40
	1674	9	6.63
	1983	1	7.80
	1099	3	6.22
	1178	2	6.43
Average		34	7.08
Blood Bone and Potash	1075	2	6.83
	1154	1	6.60
	1213	11	8.60
	1306	9	7.80
	1592	5	7.40
	2101	1	7.15
	1792	6	7.53
	1097	4	6.90
	1491	16	7.60
	1695	4	6.33
Average		59	7.27
Blood Bone and Beef	1311	2	7.65
	1594	4	8.75
	1852	1	8.38
Average		7	8.26
Gold Dust	1106	1	6.80
	1179	6	7.08
	1214	7	5.25
	1355	8	7.43
	1598	5	7.03
	1670	14	6.60
	1305	7	8.75
	1448	3	4.05
	1498	16	6.35
	1842	4	5.08
	1962	2	6.00
Average		73	6.40

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
4.01	0.99	11.80	10.81	9.00	1.90	1.65	2.30	1.51	1.50	....	....
4.07	0.55	12.00	11.45	9.00	1.86	1.65	2.27	1.55	1.50	....	....
4.15	0.20	12.30	12.10	9.00	2.21	1.65	2.68	1.50	1.50	....	....
3.50	0.75	11.65	10.90	9.00	1.73	1.65	2.10	1.79	1.50	....	....
2.85	0.69	10.17	9.48	9.00	2.02	1.65	2.45	1.54	1.50	....	....
2.23	0.35	10.38	10.03	9.00	1.65	1.65	2.00	1.50	1.50	....	....
4.65	0.35	11.22	10.87	9.00	1.77	1.65	2.15	1.44	1.50	....	....
3.35	0.30	10.08	9.78	9.00	1.51	1.65	1.83	2.13	1.50	....	....
3.60	0.52	11.20	10.68	9.00	1.83	1.65	2.22	1.62	1.50	$17.83	$15.48
4.17	0.13	11.13	11.00	9.00	2.11	1.65	2.59	1.50	1.50	....	....
4.04	0.09	10.73	10.64	9.00	1.90	1.65	2.32	1.61	1.50	....	....
2.50	1.00	12.10	11.10	9.00	1.77	1.65	2.15	1.94	1.50	....	....
2.31	0.91	11.10	10.19	9.00	1.74	1.65	2.12	1.52	1.50	....	....
4.87	1.01	13.28	12.27	9.00	1.78	1.65	2.16	1.71	1.50	....	....
2.35	0.50	10.00	9.50	9.00	1.91	1.65	2.32	2.02	1.50	....	....
2.00	0.47	10.00	9.53	9.00	1.91	1.65	2.32	1.52	1.50	....	....
3.83	0.34	11.07	10.73	9.00	1.65	1.65	2.00	1.38	1.50	....	....
4.40	0.70	12.70	12.00	9.00	1.95	1.65	2.37	1.41	1.50	....	....
3.85	1.62	11.80	10.18	9.00	2.09	1.65	2.54	1.30	1.50	....	....
3.43	0.68	11.39	10.71	9.00	1.88	1.65	2.29	1.59	1.50	$18.00	$15.48
2.58	1.85	12.08	10.23	9.00	1.91	1.65	2.32	1.52	1.50	....	....
3.15	1.45	13.35	11.90	9.00	2.32	1.65	2.81	1.79	1.50	....	....
2.55	0.37	11.30	10.93	9.00	2.09	1.65	2.54	1.22	1.50	....	....
2.76	1.22	12.24	11.02	9.00	2.11	1.65	2.56	1.51	1.50	$18.98	$15.48
3.25	1.10	11.15	10.05	9.00	1.76	1.65	2.14	1.83	1.50	....	....
2.30	0.72	10.10	9.38	9.00	1.84	1.65	2.23	1.70	1.50	....	....
4.82	1.26	11.33	10.07	9.00	1.65	1.65	2.00	1.83	1.50	....	....
2.12	1.40	10.95	9.55	9.00	1.67	1.65	2.03	1.82	1.50	....	....
1.99	1.08	10.10	9.02	9.00	1.88	1.65	2.28	1.64	1.50	....	....
3.88	0.77	11.25	10.48	9.00	1.82	1.65	2.25	1.84	1.50	....	....
0.98	0.77	10.50	9.73	9.00	1.53	1.65	1.86	1.56	1.50	....	....
3.60	0.58	8.23	7.65	9.00	1.68	1.65	2.03	1.74	1.50	....	....
2.88	0.70	9.93	9.23	9.00	1.58	1.65	1.92	1.67	1.50	....	....
2.20	0.85	8.13	7.28	9.00	2.36	1.65	2.87	2.14	1.50	....	....
2.65	0.50	9.13	8.65	9.00	1.84	1.65	2.23	1.74	1.50	....	....
2.79	0.88	10.07	9.19	9.00	1.78	1.65	2.17	1.77	1.50	$16.30	$15.48

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
New Orleans Acid & Fertilizer Co.—Continued.			
Goldsmith's Improved Mixture...............	1187	4	7.40
	1258	1	8.03
	1354	10	7.10
	1678	12	6.65
	2021	1	5.85
	1104	1	6.78
	1207	7	7.75
	1301	10	7.58
	1404	6	4.85
	1588	3	5.75
	1500	14	5.90
Average		69	6.69
Vegetable Grower	1343	3	5.45
	1624	1	5.13
	1219	2	7.95
Average		6	6.18
Planters' Fertilizer & Chemical Co., New Orleans, La.			
Planters' Cotton and Corn Fertilizer, No. 1....	1191	1	9.30
	1402	6	9.20
	1503	5	8.30
	1906	3	7.28
	1141	1	8.90
	1222	2	8.63
	1253	2	7.88
	1300	6	7.28
	1357	2	8.95
	1729	6	8.88
Average		34	8.46

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
Reverted Found %	Insoluble Found %	Total Found %	Available Found %	Available Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
3.00	0.23	10.63	10.40	9.00	1.90	1.65	2.30	1.81	1.50	....	....
2.45	0.37	10.85	10.48	9.00	1.65	1.65	2.00	1.64	1.50	....	....
3.23	1.15	11.48	10.33	9.00	1.75	1.65	2.12	1.61	1.50	....	....
3.46	1.02	11.13	10.11	9.00	1.76	1.65	2.14	1.57	1.50	....	....
3.40	0.58	9.83	9.25	9.00	1.82	1.65	2.21	1.50	1.50	....	....
3.78	0.50	11.02	10.52	9.00	1.91	1.65	2.32	1.39	1.50	....	....
3.15	1.38	12.28	10.90	9.00	1.84	1.65	2.23	1.37	1.50	....	....
3.02	0.85	11.45	10.60	9.00	1.56	1.65	1.90	1.64	1.50	....	....
3.27	0.76	8.88	8.12	9.00	1.50	1.65	1.82	1.71	1.50	....	....
3.17	0.83	9.75	8.92	9.00	1.65	1 65	2.00	1.86	1.50	....	....
3.00	0.70	9.60	8.90	9.00	1.65	1.65	2.00	1.57	1.50	....	....
3.27	0.76	10.63	9.87	9.00	1.73	1.65	2.09	1.61	1.50	$16.69	$15.48
1.09	0.96	7.50	6.54	6.00	2.48	2.47	3.01	4.13	4.00	....	....
3.18	0.42	8.73	8.31	6.00	2.47	2.47	3.00	4.44	4.00	....	....
1.98	1.07	11.00	9.93	6.00	1.94	2.47	2.36	2.62	4.00	....	....
2.08	0.82	9.08	8.26	6.00	2.29	2.47	2.79	3.73	4.00	$18.57	$17.10
1.14	1.56	12.00	10.44	9.50	1.66	1.65	2.01	1.63	1.50	....	....
2.72	1.18	13.10	11.92	9.50	2.54	1.65	3.07	2.01	1.50	....	....
2.92	0.73	11.95	11.22	9.50	1.67	1.65	2.03	1.96	1.50	....	....
3.32	1.35	11.95	10.60	9.50	1.65	1.65	2.00	2.28	1.50	....	....
1.83	0.79	11.52	10.73	9.50	1.65	1.65	2.00	2.00	1.50	....	....
2.69	1.18	12.50	11.32	9.50	1.59	1.65	1.93	1.66	1.50	....	....
2.55	1.22	11.65	10.43	9.50	1.56	1.65	1.89	1.92	1.50	....	....
2.24	2.18	11.70	9.52	9.50	1.48	1.65	1.80	1.64	1.50	....	....
2.61	1.74	13.30	11.56	9.50	1.36	1.65	1.65	2.18	1.50	....	....
3.10	1.50	13.48	11.98	9.50	1.55	1.65	1.88	1.86	1.50	....	....
2.51	1.34	12.32	10.97	9.50	1.67	1.65	2.03	1.91	1.50	$17.84	$15.98

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Planters' Fertilizer and Chemical Co.—Continued.			
Planters' Golden Mixture	1098	7	8.95
	1212	2	4.70
	1405	4	9.03
	1593	9	8.83
	1689	8	8.95
	1184	2	7.75
	1312	2	9.38
	1517	5	8.93
	1835	3	9.70
	2023	1	6.33
Average		43	8.26
Golden Home Mixture	1274	1	9.30
	1270	1	8.78
Average		2	9.04
McCall's Formula	1105	1	4.90
Planters' Stubbs Cotton and Corn	1221	2	7.85
	1511	7	7.03
	1735	8	7.18
	2024	1	6.88
	1146	1	7.62
	1177	3	7.40
	1298	3	6.58
	1398	3	7 50
Average		28	7.26
Planters' Raw Bone Superphosphate	1142	1	6.15
	1186	4	7.37
	1309	2	8.35
	1397	7	8.10
	1509	11	6.53
	1092	6	9.05
	1229	1	8.55
	1257	1	8.20
	1696	3	7.25
	1726	4	6.67
	1961	2	6.08
Average		42	7.48
Planters' Vegetable Grower	1625	1	7.73

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
2.40	1.20	12.55	11.35	9.50	1.75	1.65	2.12	1.86	1.50	....	....
6.53	1.27	12.50	11.23	9.50	1.77	1.65	2.15	1.90	1.50	....	....
2.53	1.02	12.58	11.56	9.50	1.66	1.65	2.02	2.04	1.50	....	....
2.82	0.90	12.55	11.65	9.50	1.68	1.65	2.04	2.56	1.50	....	....
3.14	0.86	12.95	12.09	9.50	1.69	1.65	2.05	2.06	1.50	....	....
2.27	1.08	11.10	10.02	9.50	1.73	1.65	2.10	1.67	1.50	....	....
0.61	1.51	11.50	9.99	9.50	1.10	1.65	1.33	1.59	1.50	....	....
3.18	0.52	12.63	12.11	9.50	1.49	1.65	1.81	1.88	1.50	....	....
3.44	1.34	14.48	13.14	9.50	1.41	1.65	1.71	1.54	1.50	....	....
2.60	0.52	9.45	8.93	9.50	2.04	1.65	2.48	2.52	1.50	....	....
2.95	1.02	12.23	11.21	9.50	1.63	1.65	1.98	1.96	1.50	$17.99	$15.98
2.52	1.48	13.30	11.82	9.50	1.52	1.65	1.85	2.60	1.00	....	....
1.57	1.58	11.93	10.35	9.50	1.28	1.65	1.55	2.08	1.00	....	....
2.05	1.53	12.62	11.09	9.50	1.40	1.65	1.70	2.34	1.00	$17.44	$15.58
3.27	0.83	9.00	8.17	5.00	5.85	3.71	4.67	1.16	0.50	$27.82	$17.27
1.59	1.26	10.70	9.44	7.00	1.67	1.65	2.03	2.46	2.00	....	....
2.67	0.58	10.28	9.70	7.00	1.66	1.65	2.01	2.72	2.00	....	....
2.48	0.72	10.38	9.66	7.00	1.77	1.65	2.15	2.48	2.00	....	....
3.24	0.93	11.05	10.12	7.00	2.00	1.65	2.43	3.86	2.00	....	....
1.18	0.82	9.62	8.80	7.00	1.63	1.65	1.98	2.52	2.00	....	....
1.06	0.92	9.38	8.46	7.00	1.58	1.65	1.92	2.05	2.00	....	....
2.35	1.32	10.25	8.93	7.00	1.46	1.65	1.77	2.04	2.00	....	....
3.90	1.33	12.73	11.40	7.00	1.27	1.65	1.54	2.42	2.00	....	....
2.31	0.99	10.55	9.56	7.00	1.63	1.65	1.98	2.57	2.00	$16.83	$13.88
4.26	0.98	11.39	10.41	9.50	2.47	1.65	3.00	1.74	1.50	....	....
3.06	0.15	10.58	10.43	9.50	1.75	1.65	2.12	2.54	1.50	....	....
1.50	0.85	10.70	9.85	9.50	2.02	1.65	2.46	1.64	1.50	....	....
2.93	0.77	11.80	11.03	9.50	1.77	1.65	2.15	1.74	1.50	....	....
3.50	0.97	11.00	10.03	9.50	1.80	1.65	2.19	1.78	1.50	....	....
1.26	2.02	12.33	10.31	9.50	2.16	1.65	2.62	1.51	1.50	....	....
1.50	0.98	11.03	10.05	9.50	1.93	1.65	2.34	1.22	1.50	....	....
2.32	0.36	10.88	10.52	9.50	1.80	1.65	2.19	1.40	1.50	....	....
2.46	0.42	10.13	9.71	9.50	1.99	1.65	2.42	1.32	1.50	....	....
1.78	0.50	8.95	8.45	9.50	2.15	1.65	2.61	1.76	1.50	....	....
1.94	0.41	8.43	8.02	9.50	2.01	1.65	2.44	1.70	1.50	....	....
2.41	0.76	10.66	9.89	9.50	1.99	1.65	2.41	1.67	1.50	$17.59	$15.98
3.94	0.56	12.23	11.67	7.00	2.67	2.50	3.23	3.36	3.50	$22.90	$17.80

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Ruston Oil Mill & Fertilizer Co., Ruston, La.			
Corn King	1272	2	4.78
	2128	1	6.25
	1388	2	5.75
Average		5	5.59
Cotton King	1400	6	6.75
	2189	1	7.91
	1273	3	7.43
	1494	9	8.73
	1901	22	8.30
	2057	25	8.20
	2167	2	5.25
Average		68	7.51
Garden King	1746	1	5.30
Standard Guano & Chemical Mfg. Co., New Orleans, La.			
Blood, Bone and Meat	1093	2	6.93
	1211	6	7.88
	1307	14	7.18
	1401	5	6.48
	1490	15	7.60
	1599	9	8.10
	1684	16	8.25
	1803	6	8.00
Average		73	7.55

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
4.47	0.75	10.00	9.25	8.00	2.32	2.00	2.82	2.00	2.00	....	....
2.27	0.66	9.18	8.52	8.00	2.35	2.00	2.86	2.08	2.00	....	....
4.23	0.27	10.25	9.98	8.00	2.64	2.00	3.21	1.74	2.00	....	....
3.66	0.56	9.81	9.25	8.00	2.43	2.00	2.96	1.94	2.00	$18.58	$16.00
3.95	0.50	11.20	10.70	8.00	1.89	1.75	2.29	2.16	2.00	....	....
2.59	1.33	11.83	10.50	8.00	1.39	1.75	1.67	2.00	2.00	....	....
3.27	0.50	11.20	10.70	8.00	1.82	1.75	2.21	1.36	2.00	....	....
1.92	1.55	12.20	10.65	8.00	1.60	1.75	1.95	1.51	2.00	....	....
2.50	1.15	11.95	10.80	8.00	1.43	1.75	1.74	1.24	2.00	....	....
2.28	1.15	11.63	10.48	8.00	1.29	1.75	1.56	1.40	2.00	....	....
2.34	0.71	8.30	7.59	8.00	2.58	1.75	3.12	2.02	2.00	....	....
2.69	0.98	11.19	10.20	8.00	1.71	1.75	2.08	1.67	2.00	$17.01	$15.20
2.87	0.28	8.45	8.17	8.00	2.83	3.00	3.45	2.54	3.00	$19.26	$20.00
3.49	1.33	11.75	10.42	9.50	2.22	1.65	2.70	1.86	1.50	....	....
2.32	1.85	12.05	10.20	9.50	1.87	1.65	2.27	1.63	1.50	....	....
3.09	1.56	11.83	10.27	9.50	1.84	1.65	2.23	2.34	1.50	....	....
3.83	1.17	11.48	10.31	9.50	1.89	1.65	2.29	1.67	1.50	....	....
3.08	0.80	11.48	10.68	9.50	1.88	1.65	2.28	1.66	1.50	....	....
2.60	1.40	12.10	10.70	9.50	1.83	1.65	2.22	1.67	1.50	....	....
2.82	2.01	13.08	11.07	9.50	1.69	1.65	2.05	1.66	1.50	....	....
2.52	1.61	12.13	10.52	9.50	1.75	1.65	2.12	1.52	1.50	....	....
2.97	1.47	11.99	10.52	9.50	1.87	1.65	2.27	1.75	1.50	$17.90	$15.98

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Nnmber of samples composited	Phosphoric Acid—Water soluble Found %
Standard Guano & Chemical Mfg. Co.—Continued.			
Champion Farmers' choice	1078	2	6.93
	1090	24	7.33
	1135	3	8.15
	1150	3	7.60
	1220	2	9.10
	1256	10	7.55
	1303	13	8.45
	1387	12	8.30
	1496	23	8.90
	1557	17	7.65
	1736	17	9.85
	1796	12	9.63
	2111	1	7.63
	2217	1	6.43
	1676	11	7.95
Average		151	8.10
Mississippi Home	1094	4	7.60
	1218	1	9.00
	1516	11	7.15
	1682	9	8.35
	1833	4	9.53
	2219	1	9.39
	1362	2	8.20
Average		32	8.46
McCall's Formula	1386	6	5.25
	1681	11	4.83
	1802	12	5.00
	1905	6	4.88
	1260	2	4.65
	2112	1	4.57
Average		38	4.86
Orange and Fruit Tree Fertilizer*	1848	1	......
Standard Ammoniated Soluble Guano	2106	1	8.55
	1732	2	6.83
Average		3	7.69

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*The phosphoric acid in this fertilizer is guaranteed 15 per cent insoluble and the fertilizer is valued as a bone meal.

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
4.21	1.29	12.43	11.14	9.50	2.03	1.65	2.46	1.68	1.00	....	....
3.74	1.45	12.52	11.07	9.50	2.00	1.65	2.43	1.60	1.00	....	....
2.98	1.85	12.98	11.13	9.50	1.66	1.65	2.02	1.71	1.00	....	....
2.94	1.73	12.27	10.54	9.50	1.79	1.65	2.18	2.02	1.00	....	....
1.63	1.37	12.10	10.73	9.50	1.88	1.65	2.28	1.62	1.00	....	....
1.95	1.40	10.90	9.50	9.50	1.70	1.65	2.06	2.14	1.00	....	....
1.84	1.96	12.25	10.29	9.50	1.77	1.65	2.15	1.72	1.00	....	....
3.00	1.73	13.03	11.30	9.50	1.65	1.65	2.00	1.69	1.00	....	....
1.88	0.60	11.38	10.78	9.50	1.76	1.65	2.14	1.82	1.00	....	....
1.98	2.52	12.15	9.63	9.50	1.87	1.65	2.28	2.00	1.00	....	....
0.89	1.56	12.30	10.74	9.50	1.78	1.65	2.16	1.68	1.00	....	....
2.28	1.84	13.75	11.91	9.50	1.65	1.65	2.00	1.74	1.00	....	....
1.56	1.39	10.58	9.19	9.50	1.78	1.65	2.16	2.34	1.00	....	....
3.71	1.00	11.14	10.14	9.50	1.75	1.65	2.13	2.61	1.00	....	....
3.78	0.42	12.15	11.73	9.50	1.58	1.65	1.92	2.04	1.00	....	....
2.56	1.48	12.13	10.65	9.50	1.78	1.65	2.16	1.89	1.00	$17.86	$15.58
3.50	1.18	12.28	11.10	9.50	1.73	1.65	2.10	2.27	1.50	....	....
2.59	1.66	13.25	11.59	9.50	1.77	1.65	2.15	1.54	1.50	....	....
3.29	0.56	11.00	10.44	9.50	1.81	1.65	2.21	2.73	1.50	....	....
2.01	1.94	12.30	10.36	9.50	1.65	1.65	2.00	2.39	1.50	....	....
2.34	1.46	13.33	11.87	9.50	1.65	1.65	2.00	2.16	1.50	....	....
1.29	1.61	12.29	10.68	9.50	1.65	1.65	2.00	1.65	1.50	....	....
1.35	1.45	11.00	9.55	9.50	1.60	1.65	1.95	1.78	1.50	....	....
2.34	1.41	12.21	10.80	9.50	1.69	1.65	2.07	2.07	1.50	$17.86	$15.98
2.23	1.30	8.78	7.48	5.00	4.15	3.85	5.04	1.96	1.00	....	....
3.20	0.90	8.93	8.03	5.00	3.88	3.85	4.71	1.50	1.00	....	....
1.98	1.20	8.18	6.98	5.00	4.00	3.85	4.86	1.40	1.00	....	....
1.93	1.12	7.93	6.81	5.00	4.26	3.85	5.17	1.72	1.00	....	....
2.60	1.15	8.40	7.25	5.00	3.68	3.85	4.47	2.06	1.00	....	....
1.84	1.04	7.45	6.41	5.00	3.00	3.85	3.65	2.36	1.00	....	....
3.30	1.12	8.28	7.16	5.00	3.83	3.85	4.65	1.83	1.00	$20.88	$18.12
....	12.20	20.45	8.25	....	2.94	2.75	3.57	3.76	3.00	$29.36	$23.75
2.85	1.25	12.65	11.40	9.50	1.65	1.65	2.00	1.81	1.50	....	....
4.25	1.22	12.30	11.08	9.50	1.95	1.65	2.37	1.36	1.50	....	....
3.55	1.24	12.48	11.24	9.50	1.80	1.65	2.19	1.59	1.50	$18.27	$15.98

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Standard Guano & Chemical Mfg. Co.—Continued.			
Standard Raw Bone Rice Fertilizer..........	1950	2	7.30
Standard Special Formulas as Ordered......	2195	1	4.53
	2196	3	8.48
Standard Sugar Cane	1254	3	8.18
	1314	3	8.28
	1790	8	9.48
	2103	1	8.38
	2127	1	8.45
	1910	4	8.45
Average		20	8.54
Standard Superphosphate	1319	2	6.98
Stern's Ammoniated and Raw Bone Superphosphate	1076	1	6.00
	1089	13	6.95
	1137	1	7.20
	1143	1	6.40
	1147	1	5.95
	1183	10	7.50
	1208	6	5.93
	1252	26	6.05
	1308	28	6.30
	1427	48	6.05
	1488	61	6.40
	1555	65	6.48
	1671	40	6.47
	1708	43	8.08
	1709	46	7.88
	1903	9	7.88
	2113	1	7.30
	1789	36	7.58
	1995	2	8.58
Average		438	6.89

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
2.50	1.30	11.10	9.80	9.50	1.72	1.65	2.08	1.50	1.50	$16.50	$15.98
2.10	0.82	7.45	6.63	5.05	3.32	3.37	4.03	5.30	4.50	$21.49	$19.43
1.28	1.42	11.18	9.76	8.00	3.93	4.11	4.78	2.16	2.00	$24.06	$22.75
2.06	2.11	12.35	10.24	10.00	2.57	2.50	3.12	2.15	2.00	....	....
2.15	1.32	11.75	10.43	10.00	2.71	2.50	3.29	2.04	2.00	....	....
2.17	1.30	12.95	11.65	10.00	2.65	2.50	3.22	2.00	2.00	....	....
1.84	0.91	11.13	10.22	10.00	2.72	2.50	3.31	2.45	2.00	....	....
2.47	0.71	11.63	10.92	10.00	2.59	2.50	3.15	2.48	2.00	....	....
2.03	1.37	11.85	10.48	10.00	2.26	2.50	2.74	2.00	2.00	....	....
2.12	1.29	11.94	10.66	10.00	2.58	2.50	3.14	2.19	2.00	$20.67	$19.60
2.52	1.50	11.00	9.50	9.50	1.79	1.65	2.18	1.76	1.00	$16.63	$15.58
3.91	1.09	11.00	9.91	9.50	1.85	1.65	2.25	2.83	1.50	....	....
3.97	1.38	12.30	10.92	9.50	2.13	1.65	2.59	2.18	1.50	....	....
3.15	1.67	12.02	10.35	9.50	1.78	1.65	2.16	1.59	1.50	....	....
2.78	1.14	10.82	9.68	9.50	1.74	1.65	2.11	1.83	1.50	....	....
4.16	1.04	11.15	10.11	9.50	1.73	1.65	2.10	2.01	1.50	....	....
2.70	0.40	10.60	10.20	9.50	1.73	1.65	2.10	1.58	1.50	....	....
4.60	1.55	12.08	10.53	9.50	1.81	1.65	2.20	1.59	1.50	....	....
3.96	1.32	11.33	10.01	9.50	1.80	1.65	2.19	2.36	1.50	....	....
4.25	1.18	11.73	10.55	9.50	1.73	1.65	2.10	2.44	1.50	....	....
4.65	1.43	12.13	10.70	9.50	1.87	1.65	2.27	1.54	1.50	....	....
4.17	1.08	11.65	10.57	9.50	1.79	1.65	2.17	1.54	1.50	....	....
3.47	1.20	11.15	9.95	9.50	2.04	1.65	2.48	2.00	1.50	....	....
4.13	1.25	11.85	10.60	9.50	1.79	1.65	2.17	1.68	1.50	....	....
2.82	1.38	12.28	10.90	9.50	1.74	1.65	2.11	1.72	1.50	....	....
3.15	1.50	12.53	11.03	9.50	1.65	1.65	2.00	1.60	1.50	....	....
2.65	1.45	11.98	10.53	9.50	1.67	1.65	2.03	1.52	1.50	....	....
2.26	1.37	10.93	9.56	9.50	2.21	1.65	2.69	2.27	1.50	....	....
3.23	1.49	12.30	10.81	9.50	1.85	1.65	2.25	1.24	1.50	....	....
1.39	1.18	11.15	9.97	9.50	1.91	1.65	2.32	1.20	1.50	....	....
3.44	1.27	11.63	10.33	9.50	1.84	1.65	2.23	1.83	1.50	$17.71	$15.93

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Standard Guano & Chemical Mfg. Co.—Continued.			
Vegetable Fertilizer	1087	3	5.03
	1399	2	5.95
	1255	3	5.60
	1737	3	6.68
	1799	2	7.30
Average		13	6.11
Swift Fertilizer Works, Atlanta, Ga.			
Swift's Cotton King High Grade Guano	1834	2	5.70
Swift's Cotton Plant, S. G. G.	1315	2	5.23
	1626	3	6.65
	1948	3	5.70
	1145	1	5.20
	1990	1	8.33
Average		10	6.22
Swift's Golden Harvest Standard High Grade Guano	1108	1	6.00
	1156	1	4.73
	1627	1	4.65
Average		3	5.13
Swift's Monarch High Grade Guano	1144	1	4.13
Swift's Red Steer Standard Grade Guano	1155	1	4.97
	1318	2	5.03
	1587	3	5.60
	1949	4	6.05
	1989	2	5.00
	2109	2	5.48
	1358	2	5.60
	1077	1	7.10
	1107	2	7.18
	1138	2	5.83
	1495	9	5.40
Average		30	5.75

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
2.10	1.42	8.55	7.13	6.00	3.19	3.00	3.87	5.35	5.00	....	....
2.39	2.31	10.65	8.34	6.00	4.43	3.00	5.38	5.13	5.00	....	....
2.03	1.50	9.13	7.63	6.00	2.72	3.00	3.30	5.52	5.00	....	....
2.38	1.44	10.50	9.06	6.00	2.62	3.00	3.18	5.58	5.00	....	....
1.91	1.29	10.50	9.21	6.00	2.80	3.00	3.41	5.26	5.00	....	....
2.16	1.59	9.87	8.27	6.00	3.15	3.00	3.83	5.37	5.00	$22.65	$19.60
4.18	1.97	11.85	9.88	9.00	2.28	2.47	2.77	2.27	2.00	$18.99	$18.50
4.33	1.77	11.33	9.56	9.00	1.66	1.65	2.01	1.91	1.00	....	....
4.35	1.48	12.48	11.00	9.00	2.42	1.65	2.94	1.12	1.00	....	....
4.19	2.24	12.13	9.89	9.00	1.79	1.65	2.17	1.32	1.00	....	....
2.93	2.39	10.52	8.13	9.00	1.80	1.65	2.18	2.30	1.00	....	....
2.02	1.25	11.60	10.35	9.00	1.43	1.65	1.81	2.48	1.00	....	....
3.56	1.83	11.61	9.79	9.00	1.82	1.65	2.22	1.83	1.00	$17.08	$15.08
3.56	1.94	11.50	9.56	8.00	1.67	1.65	2.03	2.17	2.00	....	....
3.60	2.00	10.33	8.33	8.00	1.77	1.65	2.15	2.09	2.00	....	....
3.99	1.71	10.35	8.64	8.00	1.87	1.65	2.27	2.46	2.00	....	....
3.72	1.88	10.73	8.84	8.00	1.77	1.65	2.15	2.24	2.00	$16.30	$14.88
2.97	1.26	8.36	7.10	8.00	3.40	3.29	4.13	3.83	4.00	$21.04	$21.73
3.52	1.07	9.56	8.49	8.00	1.69	1.65	2.06	2.31	2.00	....	....
3.00	1.62	9.65	8.03	8.00	1.78	1.65	2.17	2.45	2.00	....	....
3.73	1.57	10.90	9.33	8.00	1.76	1.65	2.14	3.23	2.00	....	....
4.06	2.29	12.40	10.11	8.00	1.66	1.65	2.01	2.00	2.00	....	....
4.64	1.21	10.85	9.64	8.00	1.65	1.65	2.00	2.00	2.00	....	....
4.38	1.27	11.13	9.86	8.00	1.84	1.65	2.23	2.95	2.00	....	....
2.70	1.25	9.55	8.30	8.00	1.56	1.65	1.89	2.80	2.00	....	....
3.19	1.21	11.50	10.29	8.00	1.62	1.65	1.97	2.08	2.00	....	....
2.23	1.92	11.33	9.41	8.00	1.38	1.65	1.68	2.21	2.00	....	....
4.48	1.62	11.93	10.31	8.00	1.66	1.65	2.02	1.86	2.00	....	....
4.97	1.01	11.38	10.37	8.00	1.66	1.65	2.02	1.64	2.00	....	....
3.72	1.46	10.93	9.47	8.00	1.66	1.65	2.02	2.32	2.00	$16.64	$14.88

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Swift's Fertilizer Works.—Continued.			
Swift's Special High Grade Guano..........	1854	1	10.15
Virginia-Carolina Chemical Co., Shreveport, La.			
Mobile Double Eagle Guano..................	1230	1	7.98
	1497	13	8.20
	1591	7	7.73
	1675	16	8.28
	1804	7	8.20
	1895	12	7.43
	1346	5	7.00
	2028	1	6.83
	2059	2	8.33
Average		64	7.77
Mobile Raw Bone Ammoniated Superphosphate	1225	1	7.45
	1304	6	7.63
	1597	4	7.38
	1763	1	8.90
	1957	2	7.15
Average		14	7.70
Mobile Standard Guano	1764	1	8.05
Royal Blood Bone and Potash................	1583	5	7.85
	1694	4	7.75
	1899	3	7.55
Average		12	7.72
Royal Animal Bone Guano....................	1628	1	6.95

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
4.84	2.06	17.05	14.99	9.50	0.20	4.12	0.25	0.14	3.00	$15.74	$25.08
3.69	2.28	13.93	11.67	10.00	1.73	1.65	2.10	1.75	1.50	....	....
3.03	1.47	12.70	11.23	10.00	1.65	1.65	2.00	1.50	1.50	....	....
3.07	1.25	12.05	10.80	10.00	1.65	1.65	2.00	2.06	1.50	....	....
2.78	1.44	12.50	11.06	10.00	1.65	1.65	2.00	1.58	1.50	....	....
3.42	1.31	12.93	11.62	10.00	1.65	1.65	2.00	1.52	1.50	....	....
2.57	2.06	12.06	10.00	10.00	1.65	1.65	2.00	1.54	1.50	....	....
3.21	1.67	11.88	10.21	10.00	1.53	1.65	1.86	1.56	1.50	....	....
2.45	2.00	11.30	9.30	10.00	2.08	1.65	2.53	1.50	1.50	....	....
2.20	1.22	11.75	10.53	10.00	1.43	1.65	1.74	2.12	1.50	....	....
2.94	1.63	12.34	10.71	10.00	1.67	1.65	2.03	1.68	1.50	$17.39	$16.48
4.46	2.82	14.73	11.91	10.00	1.76	1.65	2.14	1.56	1.50	....	....
2.54	2.83	13.00	10.17	10.00	1.65	1.65	2.00	2.71	1.50	....	....
2.60	2.12	12.10	9.98	10.00	1.93	1.65	2.34	2.40	1.50	....	....
2.79	1.51	13.20	11.69	10.00	1.81	1.65	2.20	1.72	1.50	....	....
2.83	1.47	11.45	9.98	10.00	1.89	1.65	2.29	1.50	1.50	....	....
3.04	2.15	12.90	10.75	10.00	1.81	1.65	2.19	1.98	1.50	$18.13	$16.48
3.16	1.22	12.43	11.21	10.00	1.89	1.65	2.29	2.20	2.00	$19.02	$16.88
4.13	1.32	13.30	11.98	10.00	2.00	1.65	2.43	2.03	1.50	....	....
3.80	1.30	12.85	11.55	10.00	1.84	1.65	2.23	1.52	1.50	....	....
3.88	1.62	13.05	11.43	10.00	1.70	1.65	2.06	0.70	1.50	....	....
3.93	1.41	13.07	11.65	10.00	1.85	1.65	2.24	1.41	1.50	$18.70	$16.48
2.93	4.02	13.90	9.88	9.00	1.74	1.65	2.12	1.00	1.00	$16.25	$15.08

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Virginia-Carolina Chemical Co.—Continued.			
Royal Cotton Boll Guano	1190	1	6.30
	1226	1	7.25
	1359	4	5.85
	1502	10	7.05
	1960	2	6.73
	2162	1	6.43
	1697	3	8.70
	1839	4	7.88
Average		26	7.02
Royal Fruit Grower	2026	1	5.58
Royal High Grade Guano	1316	2	6.83
	1690	4	7.90
	1727	6	8.18
	1227	1	8.65
	1959	2	7.03
Average		15	7.72
Royal Vegetable Fertilizer	1133	1	6.25
	1453	2	5.05
	1507	6	6.18
	1691	2	7.10
	1836	3	7.95
	1851	1	5.83
	2029	1	5.33
	2163	1	6.63
Average		17	6.29
Scott's Ammoniated Bone	1582	4	8.18
	1967	2	6.83
	1840	3	8.38
Average		9	7.80
Scott's Gossypium Phospho Special	1748	3	8.05

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
3.78	3.10	13.18	10.08	10.00	1.77	1.65	2.16	2.19	2.00	....	....
3.43	3.17	13.85	10.68	10.00	1.79	1.65	2.17	2.11	2.00	....	....
4.30	2.18	12.33	10.15	10.00	1.89	1.65	2.29	2.20	2.00	....	....
4.33	1.27	12.65	11.38	10.00	1.88	1.65	2.28	3.29	2.00	....	....
3.98	0.97	11.68	10.71	10.00	1.84	1.65	2.23	2.02	2.00	....	....
4.67	0.90	12.00	11.10	10.00	1.75	1.65	2.13	2.00	2.00	....	....
3.65	1.48	13.83	12.35	10.00	1.48	1.65	1.80	2.01	2.00	....	....
3.17	1.45	12.50	11.05	10.00	1.58	1.65	1.92	2.04	2.00	....	....
3.91	1.82	12.75	10.94	10.00	1.75	1.65	2.12	2.23	2.00	$18.32	$16.88
3.29	1.21	10.08	8.87	8.00	2.53	2.47	3.07	6.58	5.00	$22.23	$19.90
3.54	2.21	12.58	10.37	10.00	1.75	1.65	2.13	2.00	1.50	....	....
4.14	1.44	13.48	12.04	10.00	2.09	1.65	2.54	1.52	1.50	....	....
3.92	1.68	13.78	12.10	10.00	1.76	1.65	2.14	1.50	1.50	....	....
4.53	1.82	15.00	13.18	10.00	1.63	1.65	1.98	1.58	1.50	....	....
2.68	1.79	11.50	9.71	10.00	1.68	1.65	2.04	1.60	1.50	....	....
3.76	1.79	13.27	11.48	10.00	1.78	1.65	2.17	1.64	1.50	$18.49	$16.48
5.81	1.49	13.55	12.08	8.00	2.61	2.47	3.17	5.08	4.00	....	....
2.77	0.88	8.70	7.82	8.00	3.36	2.47	4.08	4.02	4.00	....	....
4.57	1.40	12.50	10.75	8.00	2.76	2.47	3.35	3.42	4.00	....	....
3.42	1.56	12.08	10.52	8.00	2.77	2.47	3.36	3.30	4.00	....	....
2.95	1.42	12.35	10.93	8.00	2.67	2.47	3.23	3.12	4.00	....	....
2.98	0.44	9.25	8.81	8.00	2.47	2.47	3.00	2.20	4.00	....	....
2.66	0.16	8.15	7.99	8.00	2.47	2.47	3.00	2.12	4.00	....	....
4.01	1.41	12.05	10.64	8.00	2.93	2.47	3.56	3.65	4.00	....	....
3.65	1.10	11.04	9.94	8.00	2.76	2.47	3.34	3.36	4.00	$21.46	$19.10
2.82	1.23	12.23	11.00	9.00	2.10	1.65	2.55	1.95	1.00	....	....
2.95	1.22	11.00	9.78	9.00	1.90	1.65	2.31	1.00	1.00	....	....
2.72	1.45	12.55	11.10	9.00	2.14	1.65	2.60	0.84	1.00	....	....
2.83	1.30	11.93	10.63	9.00	2.05	1.65	2.49	1.30	1.00	$18.23	$15.08
2.13	2.02	12.20	10.18	10.00	1.65	1.65	2.00	2.02	2.00	$17.08	$16.88

COMPLETE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited	Phosphoric Acid—Water soluble Found %
Virginia-Carolina Chemical Co.—Continued.			
Scott's Gossypium Phospho	1317	2	7.95
	1446	3	7.25
	1496	22	7.35
	1600	13	8.13
	1679	48	7.75
	1791	24	8.13
	2056	11	7.70
	2165	1	7.43
	2218	1	7.20
	1189	1	6.93
	1215	3	5.43
	1356	6	7.90
	1897	20	7.55
	2129	1	7.50
Average		156	7.44
Scott's Meal Formula	1585	3	7.05
	1734	8	7.50
	1911	3	7.15
	1299	2	7.40
Average		16	7.28
Scott's State Standard Guano................	2185	1	7.90
	1389	4	6.85
	1442	2	6.20
	1514	7	6.03
	1680	4	6.03
	1728	7	7.75
	1909	5	6.13
	2166	1	6.20
Average		31	6.64
Virginia-Carolina Chemical Co.'s Truck Grower	1139	1	6.20
	1454	2	7.28
	1733	4	8.98
	2164	1	8.25
Average		8	7.68
Virginia-Carolina Garden Truck Special......	1629	1	3.98

FERTILIZERS.

PHOSPHORIC ACID					Nitrogen		Ammonia Found %	POTASH		Comparative Value Per Ton	
			Available								
Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found %	Guarant'd %	Found	Guarant'd
2.95	0.70	11.60	10.90	10.00	1.86	1.65	2.26	2.00	1.50	....	....
2.80	1.60	11.65	10.05	10.00	1.65	1.65	2.00	1.70	1.50	....	....
3.96	1.57	12.88	11.31	10.00	1.65	1.65	2.00	1.66	1.50	....	....
3.24	1.68	13.05	11.37	10.00	1.65	1.65	2.00	1.84	1.50	....	....
2.92	1.46	12.13	10.67	10.00	1.65	1.65	2.00	1.86	1.50	....	....
2.96	1.59	12.68	11.09	10.00	1.79	1.65	2.17	1.50	1.50	....	....
2.76	1.44	11.90	10.46	10.00	1.66	1.65	2.01	1.60	1.50	....	....
2.67	1.35	11.45	10.10	10.00	1.74	1.65	2.12	2.16	1.50	....	....
4.31	1.04	12.55	11.51	10.00	1.84	1.65	2.23	1.82	1.50	....	....
4.14	1.56	12.63	11.07	10.00	1.78	1.65	2.16	1.42	1.50	....	....
6.02	1.80	13.25	11.45	10.00	1.39	1.65	1.69	1.75	1.50	....	....
3.52	1.78	13.20	11.42	10.00	1.41	1.65	1.71	2.40	1.50	....	....
2.85	1.75	12.15	10.40	10.00	1.72	1.65	2.09	1.20	1.50	....	....
2.88	1.70	12.08	10.38	10.00	1.55	1.65	1.88	1.80	1.50	....	....
3.43	1.50	12.37	10.87	10.00	1.67	1.65	2.02	1.76	1.50	$17.62	$16.48
3.47	1.43	11.95	10.52	9.00	1.76	1.65	2.14	1.92	1.00	....	....
2.56	1.37	11.43	10.06	9.00	1.98	1.65	2.41	1.60	1.00	....	....
2.86	1.12	11.13	10.01	9.00	1.78	1.65	2.17	1.00	1.00	....	....
1.90	2.03	11.33	9.30	9.00	1.22	1.65	1.49	1.23	1.00	....	....
2.70	1.49	11.46	9.97	9.00	1.69	1.65	2.05	1.44	1.00	$16.53	$15.08
2.89	0.71	11.50	10.79	10.00	1.65	1.65	2.00	2.16	2.00	....	....
3.51	1.32	11.68	10.36	10.00	1.70	1.65	2.06	1.91	2.00	....	....
3.45	1.15	10.80	9.65	10.00	1.68	1.65	2.04	2.01	2.00	....	....
2.97	0.70	9.70	9.00	10.00	1.84	1.65	2.23	2.14	2.00	....	....
1.72	2.00	9.75	7.75	10.00	1.69	1.65	2.05	2.16	2.00	....	....
3.25	1.05	12.05	11.00	10.00	1.50	1.65	1.82	2.12	2.00	....	....
2.69	1.84	10.66	8.82	10.00	1.69	1.65	2.05	2.00	2.00	....	....
2.58	0.67	9.45	8.78	10.00	1.95	1.65	2.37	2.08	2.00	....	....
2.88	1.18	10.70	9.52	10.00	1.71	1.65	2.08	2.07	2.00	$16.65	$16.88
3.73	3.74	13.67	9.93	8.00	2.12	2.06	2.57	6.35	6.00	....	....
3.47	1.33	12.08	10.75	8.00	2.14	2.06	2.60	5.66	6.00	....	....
3.46	1.71	14.10	12.39	8.00	0.64	2.06	0.78	3.10	6.00	....	....
3.02	1.21	12.48	11.27	8.00	0.50	2.06	0.61	7.96	6.00	....	....
3.42	2.00	13.08	11.09	8.00	1.35	2.06	1.64	5.77	6.00	$20.03	$19.39
3.12	0.90	8.00	7.10	6.00	2.88	4.94	3.50	4.26	4.00	$19.72	$25.01

PHOSPHORIC ACID AND

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Clinton Cotton Oil Co.,		
Clinton, La.		
Corn Fertilizer	2022	1
	2172	1
Average		2
Special Fertilizer, No. 2	1459	1
	1750	2
	2173	1
	2183	1
Average		5
New Orleans Acid & Fertilizer Company,		
Gretna, La.		
Special Sugar Cane Grower	1182	6
	1794	11
	1966	2
	1993	3
	1216	6
Average		28
Planters' Fertilizer & Chemical Company,		
New Orleans, La.		
Planters' Boll Weevil Special	1951	3
Standard Guano & Chemical Mfg. Company,		
New Orleans, La.		
Special Formula	2192	11
Special Formulas as Ordered	2197	1
	2198	11
	2199	3
Virginia-Carolina Chemical Company,		
Shreveport, La.		
Virginia-Carolina Special Formula	1765	2
	1978	1
Average		3

NITROGEN FERTILIZERS.

PHOSPHORIC ACID						Nitrogen		Ammonia Found %	Comparative Value Per Ton	
				Available						
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found	Guarant'd
7.13	3.39	0.41	10.13	10.52	4.05	3.01	3.00	3.66	....	....
5.05	4.03	0.92	10.00	9.08	4.05	3.27	3.00	3.98	....	....
6.09	3.71	0.67	10.07	9.80	4.05	3.14	3.00	3.82	$19.85	$13.65
4.85	4.44	0.71	10.00	9.29	9.60	3.43	2.00	4.16	....	....
7.58	2.50	0.37	10.45	10.08	9.60	2.38	2.00	2.89	....	....
6.00	3.60	0.65	10.25	9.60	9.60	3.38	2.00	4.11	....	....
6.74	3.24	0.52	10.50	9.98	9.60	2.68	2.00	3.26	....	....
6.29	3.45	0.56	10.30	9.74	9.60	2.97	2.00	3.61	$19.24	$16.00
6.58	0.82	1.08	8.48	7.40	7.00	5.74	5.00	6.97	....	....
4.58	2.03	0.77	7.38	6.61	7.00	5.15	5.00	6.25	....	....
6.43	3.05	0.40	9.88	9.48	7.00	5.07	5.00	6.15	....	....
6.75	2.51	0.57	9.83	9.26	7.00	5.10	5.00	6.18	....	....
6.78	2.40	0.80	9.98	9.18	7.00	4.71	5.00	5.72	....	....
6.22	2.16	0.72	9.11	8.38	7.00	5.15	5.00	6.25	$24.86	$23.00
8.53	3.60	1.50	13.63	12.13	11.00	1.73	1.65	2.09	$17.67	$16.28
8.55	2.39	1.36	12.30	10.94	8.00	4.66	4.12	5.66	$25.85	$21.18
4.33	2.38	0.92	7.63	6.71	4.00	6.05	6.00	7.35	$26.07	$23.20
7.25	2.67	1.78	11.70	9.92	8.00	4.38	4.11	5.32	$23.94	$21.15
6.75	2.78	2.12	11.65	9.53	8.50	4.61	4.11	5.60	$24.28	$21.65
6.88	3.47	1.70	12.05	10.35	8.00	3.30	3.30	4.01	....	....
7.08	3.12	1.80	12.00	10.20	8.00	3.36	3.30	4.08	....	....
6.98	3.30	1.75	12.03	10.28	8.00	3.33	3.30	4.05	$20.94	$18.56

PHOSPHORIC ACID AND

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Gulfport Cotton Oil Fertilizer and Manufacturing Co., Gulfport, Miss.		
Primo H. G. Acid Phosphate and Potash	1900	12
	1994	3
Average		15
Primo H. G. Acid Phosphate and Potash	1955	2
New Orleans Acid and Fertilizer Co., Gretna, La.		
Dissolved Bone and Potash	1586	8
	1739	8
	1445	2
	1953	2
	2168	1
	1114	1
Average		22
Planters' Fertilizer and Chemical Co., New Orleans, La.		
Dissolved Bone and Potash	1954	3
Standard Guano and Chemical Manufacturing Co., New Orleans, La.		
Acid Phosphate and Potash	1153	1
	1363	2
	1741	15
	1844	5
	1997	2
	1894	4
Average		29
Dissolved Bone and Potash	1725	6
	2194	1
	1847	3
	1952	2
Average		12

POTASH FERTILIZERS.

PHOSPHORIC ACID						POTASH		Comparative Value per Ton	
				Available					
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %	Found	Guaranteed
10.93	3.43	0.72	15.08	14.36	12.00	2.14	2.00	....	....
12.00	2.24	1.46	15.70	14.24	12.00	2.16	2.00	....	....
11.47	2.84	1.09	15.39	14.30	12.00	2.15	2.00	$16.02	$13.60
9.85	2.94	1.21	14.00	12.79	10.00	3.06	4.00	$15.24	$13.20
9.10	3.98	1.00	14.08	13.08	10.00	2.12	2.00	....	....
10.35	4.01	0.44	14.80	14.36	10.00	2.94	2.00	....	....
9.18	2.90	0.27	12.35	12.08	10.00	2.72	2.00	....	....
7.95	2.96	0.42	11.33	10.91	10.00	2.02	2.00	....	....
7.75	4.38	0.62	12.75	12.13	10.00	2.04	2.00	....	....
7.62	6.35	1.33	15.30	13.97	10.00	1.61	2.00	....	....
8.66	4.10	0.68	13.44	12.75	10.00	2.24	2.00	$14.54	$11.60
7.45	3.36	0.89	11.70	10.81	10.00	4.24	4.00	$14.20	$13.20
7.18	4.80	2.68	14.66	11.98	10.00	2.06	2.00	....	....
7.55	5.09	1.36	14.00	12.64	10.00	2.00	2.00	....	....
8.00	4.73	3.15	15.88	12.73	10.00	2.00	2.00	....	....
11.33	4.91	0.94	17.18	16.24	10.00	2.00	2.00	....	....
6.58	2.89	3.68	13.15	9.47	10.00	2.30	2.00	....	....
7.50	4.25	3.50	15.25	11.73	10.00	1.74	2.00	....	....
8.02	4.45	2.55	15.02	12.47	10.00	2.02	2.00	$14.09	$11.60
9.75	3.27	2.51	15.53	13.02	10.00	4.10	4.00	....	....
6.45	5.31	2.12	13.88	11.76	10.00	4.94	4.00	....	....
11.05	2.04	2.41	15.50	13.09	10.00	3.48	4.00	....	....
8.35	4.04	4.04	16.43	12.39	10.00	2.86	4.00	....	....
8.90	3.67	2.77	15.34	12.57	10.00	3.89	4.00	$15.68	$13.20

PHOSPHORIC ACID AND

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Standard Guano & Chemical Mfg Co.—Continued.		
High Grade Acid Phosphate and Potash	1800	2
Swift Fertilizer Works, Atlanta, Ga.		
Swift's Farmers' Home H. G. P. & P	1140	1
Virginia-Carolina Chemical Co., Shreveport, La.		
Royal Compound	1768	3
	2031	1
	2171	1
	1231	1
Average		6
Royal Potash Compound	2155	1
	1767	1
	2030	1
Average		3

POTASH FERTILIZERS.

PHOSPHORIC ACID						POTASH		Comparative Value Per Ton	
				Available					
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %	Found	Guarant'd
10.80	3.29	4.31	18.40	14.09	12.00	2.00	2.00	$15.69	$13.60
6.60	3.29	1.56	11.45	9.89	10.00	3.44	4.00	$12.64	$13.20
8.50	3.23	1.75	13.48	11.73	10.00	2.04	2.00	....	....
8.63	4.26	0.61	13.50	12.89	10.00	2.75	2.00	....	....
6.25	4.16	1.09	11.50	10.41	10.00	2.47	2.00	....	....
6.23	5.00	3.12	14.35	11.23	10.00	1.79	2.00	....	....
7.40	4.16	1.64	13.21	11.57	10.00	2.26	2.00	$13.38	$11.60
5.60	5.50	2.25	13.35	11.10	10.00	4.14	4.00	....	....
9.33	3.42	1.68	14.43	12.75	10.00	1.10	4.00	....	....
6.53	2.99	1.18	10.70	9.52	10.00	2.66	4.00	....	....
7.15	3.97	1.70	12.83	11.12	10.00	2.63	4.00	$13.22	$13.20

ACID

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Arcadia Cotton Oil Co.,		
Arcadia, La.		
Acid Phosphate	1615	5
	2201	1
Average		6
Arkansas Fertilizer Co.,		
Little Rock, Ark.		
White Diamond Acid Phosphate	1757	2
The Armour Fertilizer Works,		
East St. Louis, Ill.		
Star Phosphate	1774	1
Caddo Fertilizer Co.,		
Shreveport, La.		
Acid Phosphate	1607	10
	1758	2
	1889	6
	2122	1
Average		19
Potash Acid*	1982	1
	2116	1
Average		2
Capital Fertilizer and Manufacturing Co.,		
Jackson, Miss.		
High Grade Acid Phosphate	1618	3
Standard Acid Phosphate	1771	4
Clinton Cotton Oil Co.,		
Clinton, La.		
Acid Phosphate	1367	2

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* No Potash in these samples.

PHOSPHATES.

PHOSPHORIC ACID						Comparative Value Per Ton	
				AVAILABLE			
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found	Guaranteed
11.33	5.14	1.03	17.50	16.47	14.00		
11.68	4.27	0.55	16.50	15.95	14.00		
11.51	4.71	0.79	17.00	16.21	14.00	$16.21	$14.00
14.50	2.38	0.70	17.58	16.88	14.00	$16.88	$14.00
10.30	5.36	1.42	17.08	15.66	14.00	$15.66	$14.00
10.50	4.41	1.57	16.48	14.91	14.00		
10.53	5.37	1.60	17.50	15.90	14.00		
11.70	3.53	1.52	16.75	15.23	14.00		
12.00	4.50	1.60	18.10	16.50	14.00		
11.18	4.45	1.57	17.21	15.64	14.00	$15.64	$14.00
12.25	3.43	1.75	17.43	15.68	10.00		
12.78	3.65	1.62	18.05	15.43	10.00		
12.52	3.54	1.69	17.74	15.56	10.00	$15.56	$10.00
13.73	3.13	0.37	17.23	16.86	14.00	$16.86	$14.00
12.80	4.27	0.76	17.83	17.07	12.00	$17.07	$12.00
9.45	7.25	1.80	18.50	16.70	12.00	$16.70	$12.00

ACID

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Federal Chemical Co., **Nashville, Tenn.** Pure High Grade Acid Phosphate	2061	4
Gulfport Cotton Oil Fertilizer and Manufacturing Co., **Gulfport, Miss.** Primo High Grade Acid Phosphate	1420	7
	1617	4
	1892	3
	2119	1
Average		15
Primo Standard Acid Phosphate	1772	1
	1999	1
	2138	1
Average		3
Hazlehurst Oil Mill and Fertilizer Co., **Hazlehurst, Miss.** High Grade Acid Phosphate	1237	1
	1117	1
	1152	1
	1773	1
Average		4
Jackson Fertilizer Co., **Jackson, Miss.** High Grade Acid Phosphate	1239	1
	1353	6
	1620	4
	1893	5
	2118	1
	2170	1
Average		18

PHOSPHATES.

PHOSPHORIC ACID						Comparative Value Per Ton	
				AVAILABLE			
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found	Guaranteed
10.00	6.85	1.55	18.40	16.85	14.00	$16.85	$14.00
13.08	4.64	0.88	18.60	17.72	14.00		
12.13	4.30	1.30	17.73	16.43	14.00		
13.45	2.68	1.20	17.33	16.13	14.00		
13.60	2.81	0.59	17.00	16.41	14.00		
13.07	3.61	0.99	17.67	16.67	14.00	$16.67	$14.00
11.90	4.31	1.27	17.48	16.21	12.00		
13.78	4.79	1.41	19.98	18.57	12.00		
14.15	2.92	0.86	17.93	17.07	12.00		
13.28	4.01	1.18	18.46	17.28	12.00	$17.28	$12.00
11.23	4.74	1.86	17.83	15.97	14.00		
13.03	4.95	0.97	18.95	17.98	14.00		
11.62	5.44	1.56	18.62	17.06	14.00		
11.00	5.46	2.67	19.13	16.46	14.00		
11.72	5.15	1.77	18.63	16.87	14.00	$16.87	$14.00
11.40	3.62	2.48	17.50	15.02	14.00		
11.18	3.89	2.46	17.53	15.07	14.00		
10.80	4.93	1.35	17.08	15.73	14.00		
12.75	3.76	1.92	18.43	15.51	14.00		
13.19	3.11	1.75	18.05	16.30	14.00		
10.80	6.47	1.06	18.33	17.27	14.00		
11.69	4.30	1.84	17.82	15.82	14.00	$15.82	$14.00

ACID

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Meridian Fertilizer Factory, Meridian, Miss.		
Meridian English Acid Phosphate	1619	1
	2120	1
	2032	1
Average		3
Meridian So. Acid Phosphate	1604	9
	1622	2
	1724	7
	1956	5
Average		23
New Orleans Acid and Fertilizer Co., Gretna, La.		
Black Diamond Acid Phosphate	1185	3
	1240	5
	1351	12
	1417	6
	1499.	10
	1722	11
	1971	2
Average		49
Crescent City Acid Phosphate	1088	3
	1236	1
	1352	10
	1440	4
	1614	8
	1972	2
Average		28
High Grade Acid Phosphate	1612	6
	1366	2
	1116	1
	1985	1
Average		10

PHOSPHATES.

PHOSPHORIC ACID						Comparative Value Per Ton	
				AVAILABLE			
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found	Guaranteed
9.50	5.83	0.87	16.20	15.33	14.00		
10.00	5.73	1.77	17.50	15.73	14.00		
10.00	4.42	1.33	15.75	14.42	14.00		
9.83	5.33	1.32	16.48	15.16	14.00	$15.16	$14.00
11.63	2.94	2.06	16.63	14.57	14.00		
9.10	4.93	0.60	14.63	14.03	14.00		
13.85	2.90	0.48	17.23	16.75	14.00		
11.10	3.79	1.31	16.20	14.89	14.00		
11.42	3.64	1.11	16.17	15.06	14.00	$15.06	$14.00
9.25	2.84	0.71	12.80	12.09	12.00		
10.25	2.74	2.06	15.05	12.99	12.00		
11.18	3.67	1.10	15.95	14.85	12.00		
10.15	3.53	1.47	15.15	13.68	12.00		
9.35	4.00	1.05	14.40	13.35	12.00		
10.15	5.04	1.61	16.80	15.19	12.00		
12.58	2.45	0.47	15.50	15.03	12.00		
10.42	3.47	1.21	15.09	13.88	12.00	$13.88	$12.00
9.40	5.39	1.06	15.85	14.79	12.00		
12.95	1.39	0.91	15.25	14.34	12.00		
10.35	3.75	0.55	14.65	14.10	12.00		
9.80	3.88	0.95	14.63	13.68	12.00		
11.45	2.63	0.65	14.73	14.08	12.00		
12.60	3.00	0.55	16.15	15.60	12.00		
11.09	3.34	0.78	15.21	14.43	12.00	$14.43	$12.00
16.15	1.78	0.45	18.38	17.93	16.00		
14.95	2.60	0.73	18.28	17.55	16.00		
12.60	6.25	1.55	20.40	18.85	16.00		
15.95	1.89	0.50	18.34	17.84	16.00		
14.91	3.13	0.81	18.85	18.04	16.00	$18.04	$16.00

ACID

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Planters' Fertilizer and Chemical Co., New Orleans, La.		
Acid Phosphate	1613	2
Acid Phosphate	1769	1
Planters' Acid Phosphate	1115	1
	1176	5
	1210	6
	1365	8
	1419	4
	1853	3
Average		27
Planters' High Grade Acid Phosphate	1605	10
	1350	3
Average		13
Planters' High Grade Acid Phosphate	1589	10
	1720	9
Average		19
Ruston Oil Mill and Fertilizer Co., Ruston, La.		
Acid Phosphate	1621	4
	1271	1
	1437	3
	2060	14
Average		22
Standard Guano and Chemical Manufacturing Co., New Orleans, La.		
Acid Phosphate	1623	4
	1856	1
	2137	1
	2202	3
Average		9

PHOSPHATES.

PHOSPHORIC ACID				AVAILABLE		Comparative Value Per Ton	
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found	Guaranteed
13.15	1.70	1.25	16.10	14.85	14.00	$14.85	$14.00
12.50	3.60	0.85	16.95	16.10	12.00	$16.10	$12.00
12.75	4.26	1.24	18.25	17.01	12.00		
11.58	1.24	0.36	13.18	12.84	12.00		
12.05	1.60	0.85	14.50	13.65	12.00		
11.60	1.58	1.82	15.00	13.18	12.00		
11.55	2.25	0.95	14.75	13.80	12.00		
9.90	3.25	0.40	13.55	13.15	12.00		
11.57	2.36	0.94	14.87	13.94	12.00	$13.94	$12.00
13.73	3.35	1.47	18.55	17.08	16.00		
12.43	2.87	1.25	16.50	15.30	16.00		
13.08	3.11	1.36	17.53	16.19	16.00	$16.19	$16.00
10.45	3.60	1.75	15.80	14.05	14.10		
10.93	4.95	1.30	17.18	15.88	14.10		
10.69	4.28	1.53	16.49	14.97	14.10	$14.97	$14.10
11.95	4.80	0.38	17.13	16.75	16.50		
9.80	4.93	0.40	15.13	14.73	16.50		
10.38	5.35	0.17	15.90	15.73	16.50		
10.85	4.90	0.68	16.43	15.75	16.50		
10.75	5.00	0.41	16.15	15.74	16.50	$15.74	$16.50
9.55	4.17	2.26	15.98	13.72	12.00		
11.08	2.01	2.84	15.93	13.09	12.00		
10.75	2.18	2.37	15.30	12.93	12.00		
10.58	1.75	3.97	16.30	12.33	12.00		
10.49	2.53	2.86	15.88	13.02	12.00	$13.02	$12.00

ACID

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Standard Guano and Chemical Mfg. Co.—Continued.		
Acid Phosphate	1079	1
	1095	6
	1151	1
	1217	3
	1418	8
	1558	40
	1685	20
	1855	4
	1984	1
	1180	3
	1262	7
	1364	3
Average		97
Swift's Fertilizer Works, **Atlanta, Ga.**		
Swift's Chatahoochee Standard Grade Acid Phosphate	1136	1
Swift's Cultivator High Grade Acid Phosphate	2121	1
Virginia-Carolina Chemical Co., **Shreveport, La.**		
Royal Acid Phosphate	1795	2
Scott's High Grade Acid Phosphate	1188	1
	1238	1
	1421	5
	1606	8
	1721	5
	1891	11
Average		31
Virginia-Carolina High Grade Acid Phosphate	1616	4
	1770	2
	2117	1
Average		7

PHOSPHATES

PHOSPHORIC ACID						Comparative Value Per Ton	
				AVAILABLE			
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found	Guaranteed
11.45	5.58	1.72	18.75	17.03	14.00		
11.97	4.85	1.86	13.68	16.82	14.00		
13.15	1.53	2.12	16.80	14.68	14.00		
9.45	4.63	3.05	17.13	14.08	14.00		
11.38	3.44	2.73	17.55	14.82	14.00		
10.93	5.02	0.85	16.80	15.95	14.00		
12.33	1.85	2.50	16.68	14.18	14.00		
14.50	2.60	1.40	18.50	17.10	14.00		
16.38	2.84	0.81	20.03	19.22	14.00		
11.38	1.88	2.52	15.78	13.26	14.00		
10.60	2.65	2.85	16.10	13.25	14.00		
10.10	3.51	0.62	14.23	13.61	14.00		
11.97	3.37	1.92	17.25	15.33	14.00	$15.33	$14.00
9.03	4.23	1.64	14.90	13.26	12.00	$13.26	$12.00
12.22	4.59	1.59	18.40	16.81	14.00	$16.81	$14.00
12.28	3.80	1.85	17.93	16.08	12.00	$16.08	$12.00
11.98	4.72	0.30	17.00	16.70	14.00		
11.08	3.02	3.10	17.20	14.10	14.00		
10.88	5.38	1.57	17.83	16.26	14.00		
10.70	4.87	1.51	17.08	15.57	14.00		
12.00	4.17	1.46	17.63	16.17	14.00		
10.88	4.53	1.79	17.20	15.41	14.00		
11.25	4.45	1.62	17.32	15.70	14.00	$15.70	$14.00
12.70	3.75	0.40	16.85	16.45	14.00		
10.93	5.00	1.75	17.68	15.93	14.00		
10.12	6.51	0.97	17.60	16.63	14.00		
11.25	5.09	1.04	17.38	16.34	14.00	$16.34	$14.00

ACID

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Virginia-Carolina Chemical Company.—Continued.		
Virginia-Carolina Superphosphate	1439	4
	1522	13
	1740	8
	1801	6
	1998	2
	2123	1
	2169	1
	1890	7
	2203	6
Average		48

BONE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
The Armour Fertilizer Works, **East St. Louis, Ill.** Bone Meal	1845	1
The Armour Fertilizer Works, **Fort Worth, Tex.** Raw Bone Meal	2001	1
New Orleans Acid and Fertilizer Co., **Gretna, La.** Bone Meal	1[illegible]91	3

PHOSPHATES

PHOSPHORIC ACID						Comparative Value Per Ton	
				AVAILABLE			
Water soluble Found %	Reverted Found %	Insoluble Found %	Total Found %	Found %	Guarant'd %	Found	Guaranteed
11.98	5.02	1.55	18.55	17.00	16.00		
10.98	5.62	1.45	18.05	16.60	16.00		
12.90	4.44	1.72	19.05	17.33	16.00		
12.93	3.77	1.75	18.45	16.70	16.00		
12.35	4.27	1.81	18.43	16.62	16.00		
12.38	4.93	1.69	19.00	17.31	16.00		
11.68	4.80	1.82	18.30	16.48	16.00		
11.00	5.23	1.37	17.60	16.23	16.00		
8.51	7.74	2.25	18.50	16.25	16.00		
11.63	5.09	1.71	18.44	16.72	16.00	$16.72	$16.00

MEALS

PHOSPHORIC ACID				NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Total							
Insoluble Found %	Found %	Guarant'd %	Available Found %	Found %	Guarant'd %		Found	Guaranteed
....	32.15	24.00	....	2.20	2.47	2.67	$33.20	$27.60
....	26.00	22.00	....	4.15	3.70	5.04	$34.91	$30.18
15.78	24.15	28.00	8.37	3.13	3.00	3.86	$30.13	$32.60

BONE

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Planters' Fertilizer and Chemical Co.,		
New Orleans, La.		
Planters' Bone Meal	1101	3
	1630	1
Average		4
Standard Guano and Chemical Manufacturing Co.,		
New Orleans, La.		
Pure Raw Ground Bone	1081	2
	1100	44
	1134	3
	1148	4
	1233	3
	1348	24
	1447	3
	1489	25
	1556	15
	1793	8
	2000	2
	2115	1
	1677	26
	1181	6
	1261	14
Average		180
Swift's Fertilizer Works,		
Chicago, Ill.		
Swift's Bone Meal, High Grade	1730	5
Swift & Co., Ltd.,		
Chicago, Ill.		
Swift's Pure Bone Meal	1373	1
	2154	7
	2224	1
	1082	1
	2134	2
Average		12

MEALS

PHOSPHORIC ACID				NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Total							
Insoluble Found %	Found %	Guarant'd %	Available Found %	Found %	Guarant'd %		Found	Guarant'd
....	19.60	16.00	....	3.28	2.50	3.98	....	....
....	17.95	16.00	....	2.55	2.50	3.10	....	....
....	18.78	16.00	....	2.92	2.50	3.54	$24.95	$21.30
....	22.65	18.50	....	2.65	2.50	3.22	....	....
....	18.57	18.50	....	3.23	2.50	3.92	....	....
....	20.42	18.50	....	2.85	2.50	3.46	....	....
....	19.90	18.50	....	2.85	2.50	3.46	....	....
....	18.80	18.50	....	3.06	2.50	3.71	....	....
....	20.93	18.50	....	3.67	2.50	4.46	....	....
....	19.40	18.50	....	3.28	2.50	3.98	....	....
....	21.85	18.50	....	3.10	2.50	3.76	....	....
....	18.50	18.50	....	2.86	2.50	3.47	....	....
....	20.95	18.50	....	3.11	2.50	3.78	....	....
....	19.90	18.50	....	2.73	2.50	3.31	....	....
....	20.80	18.50	....	3.18	2.50	3.86	....	....
....	19.80	18.50	....	3.28	2.50	3.98	....	....
....	17.13	18.50	....	2.85	2.50	3.46	....	....
....	14.95	18.50	....	2.60	2.50	3.16	....	....
....	19.63	18.50	....	3.02	2.50	3.67	$25.97	$23.30
....	29.00	25.00	....	2.49	2.49	3.02	$31.67	$28.47
....	27.43	25.00	....	2.56	2.50	3.11	....	....
....	28.40	25.00	....	2.50	2.50	3.04	....	....
....	27.55	25.00	....	2.55	2.50	3.11	....	....
....	28.50	25.00	....	2.42	2.50	2.94	....	....
....	29.40	25.00	....	2.40	2.50	2.92	....	....
....	28.26	25.00	....	2.49	2.50	3.02	$31.07	$28.50

TANKAGES.

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
The Armour Fertilizer Works, Chicago, Ill.		
* 8-15 Tankage	1248	1
	1250	1
	1286	1
	1289	1
	1175	1
	1174	1
	1249	1
	1267	1
	1283	1
	1284	1
	1285	1
	1287	1
	1288	1
	1290	1
	1291	1
	1391	1
	1396	1
	1467	1
	1546	1
	1545	1
	1776	1
	1857	1
	1858	1
	1859	1
	1251	1
Average		25
10-10 Tankage	1293	1
	1294	1
	1295	1
	1296	1
	1380	1
	1381	1
	1382	1
	1383	1
	1384	1
	1385	1
	1642	1
Average		11

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* Guarantee prices on phosphoric acid in all Armour tankages are calculated on basis of Bone Phosphate of Lime. Found prices figured on total phosphoric acid found.

TANKAGES.

PHOSPHORIC ACID				NITROGEN		Ammonia Found %	Comparative Value Per Ton	
		Available						
Insoluble Found %	Total Found %	Found %	Guarant'd %	Found %	Guarant'd %		Found	Guarant'd
5.85	11.13	5.28	3.00	6.92	6.58	8.41		
5.42	11.58	6.16	3.00	6.93	6.58	8.46		
5.10	9.60	4.50	3.00	6.83	6.58	8.29		
4.17	10.55	6.38	3.00	6.87	6.58	8.35		
6.38	13.10	6.72	3.00	5.54	6.58	6.73		
6.98	12.0	5.02	3.00	5.52	6.58	6.70		
7.08	12.65	5.57	3.00	6.34	6.58	7.70		
4.94	9.40	4.46	3.00	6.52	6.58	7.92		
8.11	13.73	5.64	3.00	4.57	6 58	5.55		
6.78	12.25	5.47	3.00	4.97	6.58	6.03		
5.12	9.73	4.61	3.00	5.80	6.58	7.04		
4.80	9.55	4.75	3.00	6.48	6.58	7.87		
6.21	10.88	4.67	3.00	6.19	6 58	7.51		
6.37	10.73	4.36	3.00	6.51	6 58	7.90		
3.27	12.35	9.08	3.00	5.18	6.58	6.29		
5.00	11.55	6.55	3.00	6.26	6.58	7.60		
5.10	12.18	7.08	3.00	6.55	6 58	7.95		
2.10	10.48	8.38	3.00	6.40	6.58	7.78		
6.12	10.93	4.81	3.00	6.06	6.58	7.36		
5.05	13.75	8.70	3.00	5.34	6.58	6.48		
3.00	10.75	7.75	3.00	6.20	6.58	7.54		
6.71	11.38	4.67	3.00	5.44	6.58	6.60		
7.44	13.03	5.59	3.00	4.66	6.58	5.66		
6.19	10.75	4.56	3.00	5.95	6.58	7.22		
7.12	16.33	9.21	3.00	5.78	6.58	7.04		
5.62	11.61	6.00	3.00	5.99	6.58	7.28	$24.37	$25.50
2.68	6.23	3.55	2.00	8.60	8.23	10.44		
1.06	5.60	4.54	2.00	8.44	8.23	10.25		
3.13	6.83	3.70	2.00	8.31	8.23	10.09		
2.51	6.50	3.99	2.00	8.64	8.23	10.49		
2.02	6.25	4.23	2.00	8.44	8.23	10.25		
2.15	7.23	5.08	2.00	8.41	8.23	10.21		
1.90	6.08	4.18	2.00	8.40	8.23	10.20		
1.92	6.33	4.41	2.00	8.40	8.23	10.20		
1.93	6.60	4.67	2.00	8.63	8.23	10.46		
1.62	5.93	4.31	2.00	8.73	8.23	10.60		
2.14	6.15	4.01	2.00	8.48	8.23	10.29		
2.10	[illegible].34	4.24	2.00	8.50	8.23	10.32	$32.34	$31.00

TANKAGES.

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Schwarzschild & Sulzberger, Kansas City, Kans.		
Ground Tankage	2077	1
	2048	1
	2049	1
	2050	1
Average		4
Swift & Co., Ltd., Chicago, Ill.		
High Grade Tankage	1636	1
	1637	1
	1638	1
	1639	1
	1640	1
	1644	1
	1645	1
Average		7
High Grade Tankage	1877	1
	1533	1
	1883	1
Average		3
High Grade Tankage	1543	1
	2035	1
	2036	1
Average		3
Swift's High Grade Ground Tankage	1554	1
Swift & Co., Ltd., East St. Louis, Ill.		
Swift's High Grade Ground Tankage	1131	1
	1703	1
	1704	1
	1161	1
	1162	1
	1163	1
	1243	1
	1527	1
	1530	1
	1701	1
	1705	1
	1341	1
Average		12

TANKAGES.

Phosphoric Acid		Nitrogen		Ammonia Found %	Comparative Value Per Ton	
Found %	Guarant'd %	Found %	Guarant'd %		Found	Guarant'd
10.45	9.00	7.45	7.40	9.05		
9.58	9.00	7.72	7.40	9.38		
11.08	9.00	7.40	7.40	8.99		
9.80	9.00	7.62	7.40	9.25		
10.23	9.00	7.55	7.40	9.17	$29.74	$28.93
6.25	4.00	7.66	8.23	9.30		
5.15	4.00	7.90	8.23	9.61		
5.45	4.00	8.11	8.23	9.85		
5.85	4.00	7.99	8.23	9.70		
6.28	4.00	7.83	8.23	9.51		
4.60	4.00	7.85	8.23	0.53		
6.10	4.00	7.84	8.23	9.52		
5.67	4.00	7.88	8.23	9.57	$29.95	$30.87
9.35	4.00	7.44	7.41	9.03		
5.63	4.00	6.90	7.41	8.38		
9.85	4.00	7.30	7.41	8.87		
8.28	4.00	7.21	7.41	8.76	$28.09	$27.87
4.68	3.50	5.82	6 58	7.07		
6.25	3.50	5.88	6 58	7.15		
5.20	3.50	6.17	6.58	7.50		
5.38	3.50	5.96	6.58	7.24	$22.89	$24.73
12.43	13.00	6.25	5.76	7.59	$25.48	$23.83
6.85	5.00	7.15	6.58	8.68		
6.10	5.00	6.92	6.58	8.41		
6.40	5.00	7.12	6.58	8.64		
4.48	5.00	6.52	6.58	7.92		
4.43	5.00	6.45	6.58	7.83		
4.55	5.00	6.60	6.58	8.02		
7.45	5.00	6.31	6.58	7.66		
4.90	5.00	5.80	6 58	7.04		
4.40	5.00	6.37	6.58	7.73		
5.15	5.00	5.86	6.58	7.12		
4.95	5.00	6.58	6.58	7.99		
4.73	5.00	6.72	6.58	8.16		
5.37	5.00	6.53	6.58	7.93	$24.96	$25.06

TANKAGES.

Manufacturer or Jobber and Brand	Station Number	Number of mples composit
Swift & Co., Ltd., East St. Louis, Ill.		
Swift's High Grade Ground Tankage.............	1128	1
	1129	1
	1246	1
	1247	1
	1539	1
	1641	1
	1160	1
	1166	1
	1167	1
	1168	1
	1169	1
	1170	1
	1374	1
	1460	1
	1461	1
	1462	1
	1548	1
	1553	1
	1863	1
	2126	1
Average		20
Swift's High Grade Ground Tankage.............	1699	1
	1787	1
	1172	1
	1173	1
	1465	1
	1544	1
	1702	1
	1775	1
	1783	1
	1784	1
	1785	1
	1860	1
Average		12
High Grade Tankage.............................	2135	1

TANKAGES.

PHOSPHORIC ACID		NITROGEN		Ammonia Found %	Comparative Value Per Ton	
Found %	Guarant'd %	Found %	Guarant'd %		Found	Guarant'd
9.38	6.50	9.14	8.23	11.10		
9.68	6.50	9.39	8.23	11.40		
8.00	6.50	8.29	8.23	10.06		
7.93	6.50	8.48	8.23	10.29		
7.40	6.50	8 23	8.23	10.00		
6.70	6.50	7.92	8.23	9.61		
5.60	6.50	8.04	8.23	9.77		
5.70	6.50	8.04	8 23	9.77		
5.52	6.50	8 10	8.23	9.83		
5.65	6.50	8.05	8.23	9.77		
5.85	6.50	8.09	8.23	9.83		
4.70	6.50	6.67	8.23	8.11		
5.78	6.50	7.45	8.23	9.05		
6.83	6.50	7.96	8.23	9.66		
6.25	6.50	7.50	8.23	9.11		
6.50	6.50	7.90	8.23	9.59		
7.63	6.50	8.09	8.23	9.82		
6.53	6.50	7.91	8.23	9.61		
4.95	6.50	7.82	8.23	9.49		
5.45	6.50	7.82	8.23	9.50		
6.60	6.50	8.04	8.23	9.77	$30.75	$31.42
6.95	5 50	7.45	7.41	9.04		
7.00	5.50	7.60	7.41	9.23		
7.67	5.50	7.30	7.41	8.86		
7.51	5.50	7.29	7.41	8.85		
5.55	5.50	7.03	7.41	8.54		
7.35	5.50	7.02	7.41	8.53		
7.18	5.50	7.31	7.41	8.88		
7.78	5.50	7.25	7.41	8.80		
6.78	5.50	6.92	7.41	8.40		
6.63	5.50	6.84	7.41	8.32		
7.30	5.50	7.25	7.41	8.80		
6.40	5.50	7.09	7.41	8.62		
7.01	5.50	7.20	7.41	8.74	$27.75	$28.20
7.25	3.50	6.60	6.58	8.09	$25.85	$24.73

TANKAGES.

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Swift & Co., Ltd., Fort Worth, Texas.		
High Grade Tankage	1868	1
	1871	1
	1873	1
	1876	1
	1879	1
	1882	1
	2037	1
	2040	1
	2042	1
	2046	1
	1869	1
	1887	1
	1888	1
	2039	1
	2041	1
	2043	1
	2044	1
	2136	1
Average	....	18
High Grade Tankage	2038	1
High Grade Tankage	1528	1
	1532	1
	1706	1
	2051	1
	2052	1
	2053	1
	1529	1
	1534	1
	1878	1
Average		9

TANKAGES.

PHOSPHORIC ACID		NITROGEN		Ammonia Found %	Comparative Value Per Ton	
Found %	Guarant'd %	Found %	Guarant'd %		Found	Guarant'd
4.80	3.50	6.58	6.58	7.99		
5.23	3.50	6.70	6.58	8.13		
5.18	3.50	6.58	6.58	7.99		
5.25	3.50	6.63	6.58	8.05		
4.88	3.50	6.58	6.58	7.99		
5.40	3.50	6.58	6.58	7.99		
5.58	3.50	6.58	6.58	7.99		
5.50	3.50	6.80	6.58	8.25		
5.55	3.50	6.58	6.58	7.99		
5.40	3.50	6.75	6.58	8.21		
6.40	3.50	6.28	6.58	7.63		
5.93	3.50	6.15	6.58	7.47		
6.50	3.50	6.06	6.58	7.37		
6.13	3.50	6.20	6.58	7.54		
4.73	3.50	6.40	6.58	7.78		
6.00	3.50	6.24	6.58	7.58		
5.50	3.50	6.37	6.58	7.74		
6.23	3.50	6.54	6.58	7.95		
5.57	3.50	6.48	6.58	7.87	$24.82	$24.73
5.55	4.00	7.81	8.23	9.49	$29.68	$30.87
5.33	4.00	7.55	7.41	9.17		
6.25	4.00	7.47	7.41	9.07		
5.55	4.00	7.42	7.41	9.01		
5.80	4.00	7.47	1.41	9.08		
7.03	4.00	6.63	7.41	8.05		
9.13	4.00	7.30	7.41	8.87		
6.48	4.00	7.01	7.41	8.52		
6.75	4.00	7.35	7.41	8.92		
5.23	4.00	7.07	7.41	8.58		
6.39	4.00	7.25	7.41	8.81	$27.82	$27.87

TANKAGES

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Swift & Co., Ltd., **Fort Worth, Tex.** Swift's High Grade Ground Tankage.............	1125	1
	1123	1
	1164	1
	1244	1
	1392	1
	1393	1
	1526	1
	1531	1
	1535	1
	1538	1
	1643	1
	1292	1
	1282	1
	1394	1
	1536	1
	1537	1
	1777	1
	1778	1
	1861	1
	1165	1
Average		20
Swift & Co., Ltd., **Chicago, Ill.** High Grade Ground Tankage....................	1083	1
Swift & Co., Ltd., **Fort Worth, Tex.** Swift's High Grade Ground Tankage.............	1205	1
	1787	1
	1395	1
	1547	1
	1549	1
	1779	1
	1780	1
	1781	1
	1782	1
Average		9

TANKAGES

PHOSPHORIC ACID		NITROGEN		Ammonia Found %	Comparative Value Per Ton	
Found %	Guarant'd %	Found	Guarant'd %		Found	Guarant'd
12.53	5.00	6.84	6.58	8.31		
12.18	5.00	6.68	6.58	8.11		
5.22	5.00	7.15	6.58	8.68		
7.33	5.00	7.29	6.58	8.85		
5.00	5.00	6.64	6.58	8.06		
5.00	5.00	6.71	6.58	8.15		
5.50	5.00	6.74	6.58	8.18		
7.63	5.00	6.63	6.58	8.04		
5.68	5.00	6.46	6.58	7.84		
5.43	5.00	6.80	6.58	8.27		
5 80	5.00	6.58	6.58	7.99		
3.50	5.00	6.72	6.58	8.16		
4.03	5.00	6.98	6.58	8.47		
4.33	5.00	6.74	6.58	8.18		
5.05	5.00	6.46	6.58	7.84		
5.48	5.00	6.55	6.58	7.95		
5.50	5.00	6.48	6.58	7.87		
5.55	5.00	6.25	6.58	7.59		
6.85	5.00	6.11	6.58	7.42		
4.22	5.00	6.55	6.58	7.95		
6.09	5.00	6.67	6.58	8.10	$25.63	$25.06
12.95	....	7.42	6.59	9.02		
5.90	5.50	8.07	7.41	9.80		
6.95	5.50	7.61	7.41	9.24		
6.43	5.50	6.92	7.41	8.41		
6.58	5.50	7.00	7.41	8.50		
6.95	5.50	6.90	7.41	8.38		
6.93	5.50	7.35	7.41	8.92		
6.83	5.50	7.28	7.41	8.84		
7.48	5.50	7.20	7.41	8.75		
7.05	5.50	7.20	7.41	8.75		
6.79	5.50	7.28	7.41	8.84	$28.00	$28.20

TANKAGES

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Swift & Co., Ltd.,		
Fort Worth, Tex.		
Swift's High Grade Ground Tankage..............	1378	1
	1379	1
	1132	1
	1171	1
	1245	1
	1268	1
	1269	1
	1297	1
	1377	1
	1375	1
	1376	1
	1463	1
	1464	1
	1466	1
	1550	1
	1551	1
	1552	1
	1788	1
Average		18
Swift & Co., Ltd.,		
Kansas City, Kan.		
High Grade Tankage	1866	1
	1875	1
	1881	1
	2002	1
	2003	1
	2004	1
	2020	1
	1865	1
	1867	1
	1870	1
	1872	1
	1874	1
	1883	1
	1886	1
Average		14
High Grade Tankage	1884	1
	1885	1
Average		2

TANKAGES

PHOSPHORIC ACID		NITROGEN		Ammonia Found %	Comparative Value Per Ton	
Found %	Guarant'd %	Found %	Guarant'd %		Found	Guarant'd
6.65	6.50	8.32	8.23	10.10		
6.60	6.50	8.26	8.23	10.04		
8.85	6.50	8.15	8.23	9.89		
5.60	6.50	7.90	8.23	9.59		
7.00	6.50	7 89	8.23	9 58		
6.30	6.50	8.18	8.23	9.93		
4.95	6.50	7.52	8.23	9.14		
5.70	6.50	7.88	8.23	9.57		
7.15	6.50	7.79	8.23	8.46		
7.28	6.50	7.87	8.23	9.56		
5.63	6.50	8.60	8.23	10.44		
7.63	6.50	7.38	8.23	8.97		
7.60	6.50	7.48	8.23	9.09		
7.30	6.50	7.51	8.23	9.12		
7.15	6.50	8.19	8.23	9.94		
7.55	6.50	7.96	8.23	9.66		
6.55	6.50	7.99	8.23	9.71		
4.70	6.50	7.92	8.23	9.62		
6.68	6.50	7.93	8.23	9.63	$30.35	$31.42
5.50	3.50	6.64	6.58	8.06		
4.73	3.50	6.65	6.58	8.07		
4.73	3.50	6.65	6.58	8.07		
7.05	3.50	7.09	6.58	8.61		
6.63	3.50	6.81	6.58	8.27		
5.88	3.50	7.08	6.58	8.60		
6.70	3.50	6.86	6.58	8.33		
4.43	3.50	6.39	6.58	7.76		
4.63	3.50	6.15	6.58	7.47		
4.73	3.50	6.49	6.58	7.88		
4.83	3.50	6.30	6.58	7.65		
3.68	3.50	6.25	6.58	7.59		
4.55	3.50	6.40	6.58	7.77		
5.68	3.50	6.41	6.58	7.78		
5.27	3.50	6.58	6.58	7.99	$25.12	$24.73
4.48	4.00	6.90	7.41	8.38		
5.55	4.00	7.19	7.41	8.73		
5.02	4.00	7.05	7.41	8.56	$26.77	$27.87

TANKAGES

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Swift & Co., Ltd., **South Omaha, Neb.**		
Swift's High Grade Ground Tankage.............	1523	1
Swift & Co., Ltd., **South St. Joseph, Mo.**		
Swift's High Grade Ground Tankage.............	1540	1
	1541	1
	1542	1
	1700	1
	1759	1
	2045	1
Average		6
Swift & Co., Ltd., **St. Paul, Minn.**		
Swift's High Grade Tankage......................	1862	1
	1086	1
	1112	1
	1130	1
	1864	1
Average		6
Swift's High Grade Ground Tankage..............	1111	1
	1707	1
	1693	1
Average		3

TANKAGES

PHOSPHORIC ACID		NITROGEN		Ammonia Found %	Comparative Value Per Ton	
Found %	Guarant'd %	Found %	Guarant'd %		Found	Guarant'd
6.38	5.50	7.79	7.41	9.46	$29.77	$28.20
5.93	5.50	7.52	7.41	9.13		
6.73	5.50	7.60	7.41	9.47		
5.58	5.50	7.85	7.41	9.53		
7.55	5.50	7.51	7.41	9.12		
5.50	5.50	7.84	7.41	9.52		
5.80	5.50	7.70	7.41	9.36		
6.18	5.50	7.70	7.41	9.36	$29.43	$28.20
7.75	5.00	6.82	6.58	8.37		
10.25	5.00	6.01	6.58	7.30		
10.15	5.00	5.40	6.58	6.56		
12.68	5.00	6.54	6.58	7.94		
7.55	5.00	5.66	6.58	6.87		
9.68	5.00	6.09	6.58	7.41	$24.34	$25.06
8.90	5.50	8.38	7.41	10.17		
5.68	5.50	7.66	7.41	9.30		
6.43	5.50	7.39	7.41	8.98		
7.00	5.50	7.81	7.41	9.48	$29.97	$28.20

COTTON SE

Manufacturer or Jobber and Brand	Station Number
Abbeville Cotton Oil Company, Abbeville, La.	
Cotton Seed Meal Fertilizer	1193
	2144
	2159
	2213
	1321
	1570
	2071
Average	
Arkansas Valley Cotton Oil Company, Dardanelle, La.	
Cotton Seed Meal Fertilizer	2097
Ashley Oil and Gin Company, Wilmont, Ark.	
Cotton Seed Meal Fertilizer	1660
Bastrop Oil Company, Bastrop, La.	
Cotton Seed Meal Fertilizer	1471
	1714
	1319
	1924
Average	
Cotton Seed Meal Fertilizer	2005
	1913
	2089
Average	

ED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guarant'd
2	7.09	7.00	8.61	....	....
2	7.00	7.00	8.51	....	....
3	7.04	7.00	8.56	....	....
1	7.10	7.00	8.63	....	....
1	6.90	7.00	8.38	....	....
3	6.87	7.00	8.34	....	....
3	6.93	7.00	8.42	....	....
15	6.99	7.00	8.49	$25.77	$25.80
1	6.87	6.00	8.35	$25.38	$22.60
1	6.10	6.58	7.41	$22.92	$24.46
2	6.85	6.58	8.32	....	....
4	6.59	6.58	8.00	....	....
2	6.58	6.58	7.99	....	....
1	5.95	6.58	7.22	....	....
9	6.49	6.58	7.88	$24.17	$25.46
1	6.63	6.61	8.05	....	....
8	6.44	6.61	7.82	....	....
1	6.36	6.61	7.73	....	....
10	6.48	6.61	7.87	$24.14	$24.55

	COTTON
Manufacturer or Jobber and Brand	Station Number
Belton Oil Company,	
Belton, Tex.	
Cotton Seed Meal Fertilizer	1654
	1829
	1941
Average	
Bluff City Oil Company,	
Pine Bluff, Ark.	
Cotton Seed Meal Fertilizer	1576
	1814
	1986
	2070
	2157
Average	
Brenham Cotton Oil and Manufacturing Company,	
Brenham, Tex.	
Cotton Seed Meal Fertilizer	1478
Breaux Bridge Oil Works, Limited,	
Breaux Bridge, La.	
Cotton Seed Meal Fertilizer	1197
	1329
	1932
	2090
	2209
Average	
Butler Kyson Oil Company,	
Fayette, Miss.	
Cotton Seed Meal Fertilizer	1423

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
10	7.49	6.58	9.09	....	....
3	7.43	6.58	9.02	....	....
5	7.53	6.58	9.14	....	....
18	7.48	6.58	9.08	$27.34	$24.46
1	6.17	6.00	7.49	....	....
1	6.22	6.00	7.56	....	....
1	6.39	6.00	7.76	....	....
4	6.25	6.00	7.60	....	....
1	6.40	6.00	7.78	....	....
8	6.29	6.00	7.64	$23.53	$22.60
1	7.64	6.58	9.27	$27.85	$24.46
3	6.64	6.55	8.06	....	....
3	6.68	6.55	8.11	....	....
3	6.57	6.55	7.98	....	....
1	6.78	6.55	8.24	....	....
4	6.84	6.55	8.31	....	....
14	6.70	6.55	8.14	$24.84	$24.36
1	6.23	6.00	7.56	$23.34	$22.60

	COTTON
Manufacturer or Jobber and Brand	Station Number
Caddo Fertilizer Company,	
Shreveport, La.	
Cotton Seed Meal Fertilizer	1486
	2015
	2084
	1653
	1915
Average	
Cotton Seed Meal	1275
	1276
Average	
Capital City Oil Company,	
Baton Rouge, La.	
Cotton Seed Meal Fertilizer	2006
	2099
Average	
Central Oil Company,	
Deeson, Miss.	
Cotton Seed Meal Fertilizer	1567
	1338
	1411
	1435
Average	
Centreville Cotton Oil Company,	
Centreville, Miss.	
Cotton Seed Meal Fertilizer	1320
	1414
	1429
	1473
	1648
	1658
	1663
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
1	7.32	6.60	8.89	....	....
1	7.06	6.60	8.58	....	....
1	6.89	6.60	8.38	....	....
2	4.95	6.60	6.01	....	....
5	6.30	6.60	7.65	....	....
10	6.50	6.60	7.90	$24.20	$24.52
1	4.18	5.00	5.07	....	....
2	4.14	5.00	5.03	....	....
3	4.16	*5.00	5.05	$16.71	$19.40
1	6.55	6.00	7.96	....	....
1	5.55	6.00	6.75	....	....
2	6.05	6.00	7.36	$22.76	$22.60
2	7.69	6.58	9.34	....	....
1	6.16	6.58	7.49	....	....
2	6.32	6.58	7.68	....	....
1	6.53	6.58	7.93	....	....
6	6.68	6.58	8.11	$24.78	$24.46
1	7.10	6.00	8.62	....	....
3	7.08	6.00	8.60	....	....
1	7.07	6.00	8.58	....	....
2	6.64	6.00	8.06	....	....
1	6.26	6.00	7.61	....	....
1	6.03	6.00	7.32	....	....
1	6.97	6.00	8.46	....	....
10	6.73	6.00	8.18	$24.94	$22.60

*Not official.

	COTTON
Manufacturer or Jobber and Brand	Station Number
Centreville Cotton Oil Co.—Continued.	
Cotton Seed Meal Fertilizer	1340
	1572
Average	
Cinclare Cotton Oil Company, Cinclare, La.	
Cotton Seed Meal Fertilizer	1336
	1410
	1651
	1831
	1936
	2016
	2079
	2141
	2175
Average	
Columbia Cotton Oil Company, Magnolia, Ark.	
Cotton Seed Meal Fertilizer	1483
	2208
	2216
	2221
Average	
Concordia Oil Mill Company, Limited, Vidalia, La.	
Cotton Seed Meal Fertilizer	1661
	1830
	1916
	2011
	2077
	2140
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
1	7.00	6.58	8.50	....	....
2	6.97	6.58	8.46	....	....
3	6.99	6.58	8.48	$25.77	$24.46
1	6.51	6.00	7.90	....	....
9	6.83	6.00	8.29	....	....
10	6.61	6.00	8.02	....	....
2	6.43	6.00	7.82	....	....
10	6.69	6.00	8.12	....	....
3	6.92	6.00	8.40	....	....
4	6.58	6.00	7.99	....	....
2	6.44	6.00	7.83	....	....
3	6.04	6.00	7.34	....	....
44	6.56	6.00	7.97	$24.39	$22.60
6	7.01	6.75	8.51	....	....
3	6.89	6.75	8.37	....	....
3	6.84	6.75	8.32	....	....
1	7.00	6.75	8.52	....	....
13	6.94	6.75	8.43	$25.61	$25.00
2	6.36	7.00	7.74	....	....
2	6.30	7.00	7.65	....	....
4	6.15	7.00	7.47	....	....
1	6.41	7.00	7.79	....	....
7	6.33	7.00	7.69	....	....
2	6.39	7.00	7.77	....	....
18	6.32	7.00	7.69	$23.62	$25.80

COTTON

Manufacturer or Jobber and Brand	Station Number
Consumers' Co. Oil Co., **Forrest City, Ark.** Cotton Seed Meal Fertilizer	1826
	2087
	1917
	2146
Average	
De Soto Oil Company, **Greenville, Miss.** Cotton Seed Meal Fertilizer	1475
	1577
	1807
	2210
Average	
Dixie Cotton Oil Company, **Little Rock, Ark.** Cotton Seed Meal Fertilizer	1712
	1921
	2008
	2085
	1664
Average	
Drew Oil Mill, **Monticello, Ark.** Cotton Seed Meal Fertilizer	2014
Cotton Seed Meal Fertilizer	1828
Eastman Oil Mills, **Jonestown, Miss.** Cotton Seed Meal Fertilizer	2073
Cotton Seed Meal Fertilizer	2007
	2067
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
8	6.45	6.40	7.83	....	....
1	6.42	6.40	7.80	....	....
2	6.22	6.40	7.56	....	....
1	6.37	6.40	7.75	....	....
12	6.37	6.40	7.74	$23.78	$23.88
1	5.74	6.58	6.97	....	....
1	5.88	6.58	7.13	....	....
1	5.80	6.58	7.04	....	....
2	5.58	6.58	6.78	....	....
5	5.75	6.58	6.98	$21.80	$24.46
6	6.00	6.00	7.28	....	....
1	6.08	6.00	7.38	....	....
1	6.01	6.00	7.30	....	....
1	6.34	6.00	7.71	....	....
2	5.92	6.00	7.19	....	....
11	6.07	6.00	7.37	$22.82	$22.60
1	6.52	6.00	7.92	$24.26	$22.60
3	6.49	6.58	7.88	$24.17	$24.46
2	6.06	6.58	7.37	$22.79	$24.46
1	6.33	6.00	7.69	....	....
3	6.16	6.00	7.49	....	....
4	6.25	6.00	7.59	$23.40	$22.60

	COTTON
Manufacturer or Jobber and Brand	Station Number
Farmers' Cotton Oil Company,	
Cleburne, Tex.	
Cotton Seed Meal Fertilizer	1943
	2093
Average	
Feliciana Oil Company,	
St. Francisville, La.	
Cotton Seed Meal Fertilizer	1335
	1431
	1485
	2013
	1816
Average	
Georgetown Cotton Oil Mill,	
Georgetown, Tex.	
Cotton Seed Meal Fertilizer	1425
	1561
Average	
Hazlehurst Oil Mill & Fertilizer Company,	
Hazlehurst, Miss.	
Cotton Seed Meal Fertilizer	1199
	1562
Average	
Hill County Cotton Oil Company,	
Hillsboro, Tex.	
Cotton Seed Meal Fertilizer	1931
Hobart Cotton Oil Company,	
Hobart, Ark.	
Cotton Seed Meal Fertilizer	2065
	2075
	2206
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
3	7.24	6.58	8.79	....	....
1	7.34	6.58	8.92	....	....
4	7.29	6.58	8.86	$26.73	$24.46
1	6.60	6.00	8.01	....	....
1	7.05	6.00	8.56	....	....
1	6.50	6.00	7.89	....	....
1	6.79	6.00	8.25	....	....
2	6.35	6.00	7.70	....	....
6	6.66	6.00	8.08	$24.71	$22.60
1	7.35	6.58	8.92	....	....
1	6.84	6.58	8.31	....	....
2	7.10	6.58	8.62	$26.12	$24.46
4	6.42	6.00	7.79	....	....
1	7.08	6.00	8.60	....	....
5	6.75	6.00	8.20	$25.00	$22.60
4	7.21	6.58	8.75	$26.47	$24.46
2	6.36	6.00	7.74	....	....
2	6.34	6.00	7.71	....	....
1	6.87	6.00	8.35	....	....
5	6.52	6.00	7.93	$24.26	$22.60

	COTTON
Manufacturer or Jobber and Brand	Station Number
Homer Cotton Oil Company,	
Homer, La.	
Cotton Seed Meal Fertilizer	1127
	1333
	1487
	2212
Average	
Cotton Seed Meal Fertilizer	1710
	1808
Average	
Imperial Cotton Oil Company,	
Macon, Miss.	
Cotton Seed Meal Fertilizer	1201
	1525
Average	
Lecompte Cotton Oil Company,	
Lecompte, La.	
Cotton Seed Meal Fertilizer	1408
	1433
Average	
Lexington Compress & Oil Mill Company,	
Lexington, Miss.	
Cotton Seed Meal Fertilizer	2095
Cotton Seed Meal Fertilizer	1159
Little River Cotton Oil Company,	
Ashdown, Ark.	
Cotton Seed Meal Fertilizer	1200
	1424
	1470
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
1	6.53	6.00	7.93	....	....
1	6.43	6.00	7.80	....	....
1	7.33	6.00	8.90	....	....
1	6.90	6.00	8.39	....	....
4	6.80	6.00	8.26	$25.16	$22.60
5	7.11	6.58	8.63	....	....
1	7.22	6.58	8.77	....	....
6	7.17	6.58	8.70	$26.34	$24.46
1	7.11	6.56	8.65	....	....
1	6.63	6.56	8.04	....	....
2	6.87	6.56	8.35	$25.38	$24.39
4	7.07	6.00	8.58	....	....
1	7.54	6.00	9.15	....	....
5	7.31	6.00	8.87	$26.79	$22.60
1	6.17	6.00	7.50	$23.14	$22.60
1	6.11	6.59	7.42	$22.95	$24.49
4	6.93	6.56	8.41	....	....
1	7.20	6.56	8.74	....	....
2	7.09	6.56	8.61	....	....
7	7.07	6.56	8.59	$26.02	$24.39

	COTTON
Manufacturer or Jobber and Brand	Station Number
Longbridge Cotton Oil Company, Limited, Longbridge, La.	
Cotton Seed Meal Fertilizer	1430
	1565
	1811
	1940
	2018
	2086
	2145
	2143
	2205
Average	
Cotton Seed Meal Fertilizer	1571
Cotton Seed Meal Fertilizer	2076
	2147
	2207
Average	
Louisiana Cotton Oil Company, Shreveport, La.	
Cotton Seed Meal Fertilizer	1927
	2017
Average	
Marianna Cotton Oil Company, Marianna, Ark.	
Cotton Seed Meal Fertilizer	1914
	2012
	2081
	2151
	2211
	2223
	2153
Average	
Memphis Cotton Oil Company, Memphis, Tenn.	
Cotton Seed Meal Fertilizer	2033

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
1	6.39	6.59	7.76	....	....
6	6.35	6.59	7.71	....	....
1	6.16	6.59	7.48	....	....
2	5.90	6.59	7.16	....	....
2	6.15	6.59	7.47	....	....
1	6.13	6.59	7.46	....	....
1	6.22	6.59	7.56	....	....
1	6.02	6.59	7.32	....	....
1	6.25	6.59	7.60	....	....
16	6.17	6.59	7.50	$23.14	$24.49
1	6.49	5.80	7.88	$24.17	$21.96
2	6.26	6.18	7.61	....	....
1	6.10	6.18	7.41	....	....
3	6.30	6.18	7.66	....	....
6	6.22	6.18	7.56	$23.30	$23.18
1	6.89	6.50	8.38	....	....
2	6.87	6.50	8.34	....	....
3	6.88	6.50	8.36	$25.42	$24.20
8	6.24	6.00	7.58	....	....
1	6.53	6.00	7.93	....	....
5	6.22	6.00	7.56	....	....
1	6.39	6.00	7.77	....	....
2	6.19	6.00	7.52	....	....
2	6.24	6.00	7.59	....	....
1	5.90	6.00	7.17	....	....
20	6.24	6.00	7.59	$23.37	$22.60
1	6.07	6.00	7.37	$22.82	$22.60

COTTON

Manufacturer or Jobber and Brand	Station Number
Meridian Fertilizer Factory, **Meridian, Miss.**	
Cotton Seed Meal Fertilizer	1579
Mississippi Cotton Oil Company, **Greenville, Miss.**	
Cotton Seed Meal Fertilizer	1711
	1821
	1935
Average	
Mississippi Cotton Oil Company, **Natchez, Miss.**	
Cotton Seed Meal Fertilizer	1436
Natchez Oil Company, **Natchez, Miss.**	
Cotton Seed Meal Fertilizer	1324
	1406
	1559
	1524
Average	
Cotton Seed Meal Fertilizer	1716
	1812
	1102
Average	
Cotton Seed Meal Fertilizer	2179
New Iberia Cotton Oil and Manufacturing Company, **New Iberia, La.**	
Cotton Seed Meal Fertilizer	1195
	1371
	1412
	1578
	1656
	1933
	2068
	2214
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
1	6.45	6.00	7.83	$24.04	$22.60
4	6.18	6.59	7.51	....	....
3	6.10	6.59	7.41	....	....
4	5.94	6.59	7.21	....	....
11	6.07	6.59	7.38	$22.82	$24.49
1	6.69	6.59	8.12	$24.81	$24.49
3	6.93	6.58	8.41	....	....
2	7.13	6.58	8.67	....	....
1	7.02	6.58	8.52	....	....
1	6.44	6.58	7.83	....	....
7	6.88	6.58	8.36	$25.42	$24.46
2	6.58	6.60	7.99	....	....
5	6.95	6.60	8.44	....	....
1	6.84	6.60	8.30	....	....
8	6.79	6.60	8.24	$25.13	$24.52
1	7.07	6.00	8.59	$26.02	$22.60
5	6.88	6.00	8.36	....	....
4	6.65	6.00	8.07	....	....
2	6.65	6.00	8.07	....	....
1	6.56	6.00	7.96	....	....
6	6.25	6.00	7.59	....	....
6	6.60	6.00	8.01	....	....
2	6.27	6.00	7.62	....	....
1	6.87	6.00	8.35	....	....
27	6.59	6.00	8.00	$24.49	$22.60

COTTON

Manufacturer or Jobber and Brand	Station Number
New Roads Oil Mill and Manufacturing Company, **New Roads, La.** Cotton Seed Meal Fertilizer.	2062
North Mississippi Oil Mill, **Holly Springs, Miss.** Cotton Seed Meal Fertilizer	1560
New Orleans Acid and Fertilizer Company, **New Orleans, La.** Cotton Seed Meal Fertilizer	1428
	1476
	1924
Average	
New Orleans Cotton Seed Oil and Manufacturing Company, **New Orleans, La.** Cotton Seed Meal Fertilizer	1279
	1409
	1472
	1563
	1652
	1713
	1824
	1934
	2142
	2178
	2074
	2019
Average	
Oxford Oil Mill, **Oxford, Miss.** Cotton Seed Meal Fertilizer	2152

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
4	6.03	6.00	7.33	$22.70	$22.60
1	6.28	6.00	7.62	$23.50	$22.60
1	6.58	6.59	7.99	....	....
1	6.63	6.59	8.05	....	....
1	6.59	6.59	8.00	....	....
3	6.60	6.59	8.01	$24.52	$24.49
4	6.74	6.00	8.19	....	....
8	6.74	6.00	8.19	....	....
9	6.92	6.00	8.40	....	....
6	6.68	6.00	8.11	....	....
11	6.63	6.00	8.05	....	....
8	6.68	6.00	8.11	....	....
17	6.28	6.00	7.63	....	....
6	6.46	6.00	7.84	....	....
3	6.94	6.00	8.43	....	....
6	6.52	6.00	7.92	....	....
2	6.16	6.00	7.49	....	....
4	5.65	6.00	6.86	....	....
84	6.53	6.00	7.94	$24.30	$22.60
2	6.35	6.00	7.71	$23.72	$22.60

	COTTON
Manufacturer or Jobber and Brand	Station Number
People's Oil Mill,	
Lafayette, La.	
Cotton Seed Meal Fertilizer	1194
	1280
	1330
	1481
	1564
	1919
	2094
	1204
Average	
Petty Oil Company,	
Petty, Tex.	
Cotton Seed Meal Fertilizer	1482
Perkins Oil Company,	
Memphis, Tenn,	
Cotton Seed Meal Fertilizer	2083
Phoenix Cotton Oil Company,	
Como, Miss.	
Cotton Seed Meal Fertilizer	1647
	2158
Average	
Pine Bluff Cotton Oil Company,	
Pine Bluff, Ark.	
Cotton Seed Meal Fertilizer	1926
Planters' Cotton Oil Company,	
Sulphur Springs, Tex.	
Cotton Seed Meal Fertilizer...........................	1809
Planters' Oil Mill,	
Monroe, La.	
Cotton Seed Meal Fertilizer	1337
	1659
	1823
	2125
	1501
	1574
	1717
	2009
Average	

SEED MEAL.

Number of samples composited	NITROGEN Found %	NITROGEN Guarant'd %	Ammonia Found %	Comparative Value Per Ton Found	Comparative Value Per Ton Guaranteed
6	6.84	6.77	8.30	....	....
2	6.91	6.77	8.40	....	....
9	6.79	6.77	8.24	....	....
2	6.91	6.77	8.39	....	....
5	7.37	6.77	8.95	....	....
6	6.95	6.77	8.44	....	....
1	7.31	6.77	8.88	....	....
8	6.69	6.77	8.12	....	....
39	6.97	6.77	8.47	$25.70	$25.06
1	6.59	6.58	8.00	$24.49	$24.46
2	6.03	6.00	7.33	$22.70	$22.60
1	6.34	6.00	7.70	....	....
1	5.53	6.00	6.72	....	....
2	5.99	6.00	7.21	$22.57	$22.60
1	6.58	6.58	7.99	$24.46	$24.46
1	6.66	6.58	8.09	$24.71	$24.46
1	6.20	6.20	7.53	....	....
1	7.49	6.20	9.09	....	....
8	6.31	6.20	7.67	....	....
3	6.20	6.20	7.54	....	....
5	5.94	6.20	7.21	....	....
3	5.90	6.20	7.16	....	....
2	5.97	6.20	7.25	....	....
1	5.97	6.20	7.25	....	....
24	6.25	6.20	7.95	$23.40	$23.24

COTTON

Manufacturer or Jobber and Brand	Station Number
Planters' Oil Mill,	
Tunica, Miss.	
Cotton Seed Meal Fertilizer	1323
Raccourci Cotton Oil Company, Limited,	
Batchelor, La.	
Cotton Seed Meal Fertilizer	1744
	1920
Average	
Rayne Cotton Oil and Manufacturing Company,	
Rayne, La.	
Cotton Seed Meal Fertilizer	1923
	1241
	1328
	1581
	1479
	1667
Average	
Red River Cotton Oil Company,	
Alexandria, La.	
Cotton Seed Meal Fertilizer	1434
	2082
Average	
Cotton Seed Meal Fertilizer	1845
	1422
Average	
Richmond Cotton Oil Company,	
Kennett, Mo.	
Cotton Seed Meal Fertilizer	1655
Ringgold Cotton Oil Company,	
Ringgold, La.	
Cotton Seed Meal Fertilizer	1649

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
2	6.15	6.58	7.47	$23.08	$24.46
1	6.02	6.00	7.30	....	....
1	5.55	6.00	6.74	....	....
2	5.79	6.00	7.02	$21.93	$22.60
1	6.58	6.00	7.99	....	....
3	6.66	6.00	8.09	....	....
2	6.78	6.00	8.24	....	....
1	6.68	6.00	8.11	....	....
2	6.87	6.00	8.34	....	....
3	6.80	6.00	8.27	....	....
12	6.73	6.00	8.17	$24.94	$22.60
1	6.86	6.59	8.33	....	....
2	5.98	6.59	7.27	....	....
3	6.42	6.59	7.80	$23.94	$24.49
1	6.37	6.17	7.74	....	....
1	6.67	6.17	8.09	....	....
2	6.52	6.17	7.92	$24.26	$23.14
2	6.18	6.00	7.50	$23.18	$22.60
1	5.86	4.01	7.11	$22.15	$16.23

	COTTON
Manufacturer or Jobber and Brand	Station Number
Roberts Cotton Oil Company,	
Malden, Mo.	
Cotton Seed Meal Fertilizer	2174
	2215
	2220
Average	
Roberts Cotton Oil Company,	
Jonesboro, Ark.	
Cotton Seed Meal Fertilizer	1646
Ruston Oil Mill and Fertilizer Company,	
Ruston, La.	
Cotton Seed Meal Fertilizer	1918
	2069
	2150
	1477
Average	
Shaw Cotton Oil Company,	
Shaw, Miss.	
Cotton Seed Meal Fertilizer	2161
	2072
Average	
Shawnee Cotton Oil Company,	
Shawnee, Okla.	
Cotton Seed Meal Fertilizer	1806
	2098
Average	
Sonia Cotton Oil Company,	
Alexandria, La.	
Cotton Seed Meal Fertilizer..........................	1334
	1575
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
1	6.33	6.00	7.70	....	....
1	6.18	6.00	7.51	....	....
1	6.41	6.00	7.78	....	....
3	6.31	6.00	7.66	$23.59	$22.60
1	6.23	6.00	7.58	$23.34	$22.60
19	6.61	6.60	8.02	....	....
16	6.65	6.60	8.08	....	....
1	6.84	6.60	8.31	....	....
1	7.15	6.60	8.68	....	....
37	6.81	6.60	8.27	$25.19	$24.52
1	6.04	6.00	7.34	....	....
2	5.99	6.00	7.28	....	....
3	6.02	6.00	7.31	$22.66	$22.60
1	6.96	6.00	8.46	....	....
1	6.64	6.00	8.07	....	....
2	6.80	6.00	8.27	$25.16	$22.60
1	6.73	6.76	8.17	....	....
1	6.61	6.76	8.02	....	....
2	6.67	6.76	8.10	$24.74	$25.03

COTTON

Manufacturer or Jobber and Brand	Station Number
Standard Guano and Chemical Manufacturing Company, New Orleans, La.	
Off Cotton Seed Meal Fertilizer	1662
	2096
Average	
St. Landry Cotton Oil Company, Opelousas, La.	
Cotton Seed Meal Fertilizer	1198
	1242
	1281
	1325
	1407
	1484
	1566
	1942
	2066
	1832
	1666
Average	
St. Martin Oil Works, St. Martinsville, La.	
Cotton Seed Meal Fertilizer	1327
	1413
	1569
	1930
Average	
Cotton Seed Meal Fertilizer	2091
Sunset Cotton Oil Company, Limited, Sunset, La.	
Cotton Seed Meal Fertilizer	1203
	1277
	1668
	1944
	2078
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
1	6.48	5.76	7.87	....	....
1	6.27	5.76	7.62	....	....
2	6.38	5.76	7.75	$23.82	$21.83
4	7.35	6.58	8.92	....	....
7	7.04	6.58	8.55	....	....
2	6.94	6.58	8.43	....	....
6	6.76	6.58	8.21	....	....
2	6.83	6.58	8.30	....	....
3	6.77	6.58	8.22	....	....
3	6.73	6.58	8.17	....	....
8	6.59	6.58	8.00	....	....
11	6.60	6.58	8.02	....	....
2	6.40	6.58	7.77	....	....
3	6.53	6.58	7.93	....	....
51	6.78	6.58	8.23	$25.10	$24.46
2	6.46	7.00	7.84	....	....
2	6.90	7.00	8.38	....	....
2	6.50	7.00	7.89	....	....
4	6.66	7 00	8.09	....	....
10	6.63	7.00	8.05	$24.62	$25.80
1	6.58	6.58	7.99	$24.46	$24.46
1	7.06	6.00	8.57	....	....
7	6.44	6.00	7.83	....	....
2	6.86	6.00	8.33	....	....
3	6.61	6.00	8.02	....	....
3	6.80	6.00	8.27	....	....
16	6.75	6.00	8.20	$25.00	$22.60

COTTON

Manufacturer or Jobber and Brand	Station Number
Tensas Cotton Oil and Manufacturing Company,	
St. Joseph, La.	
Cotton Seed Meal Fertilizer	1928
	1925
Average	
Texarkana Cotton Oil Company,*	
Texarkana, Ark.	
Cotton Seed Meal Fertilizer	1743
The Union Oil Company,	
Bunkie, La.	
Cotton Seed Meal Fertilizer	1372
	1580
	1669
	1196
	1266
	1331
	1810
	2010
	2100
	2124
	2176
Average	
Cotton Seed Meal Fertilizer	1202
	1265
	1322
	1415
	2204
	1820
	1929
	2088
Average	
Cotton Seed Meal Fertilizer	1426
	1818
Average	

*Guarantee not official.

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guarant'd
3	6.12	6.00	7.43	....	....
1	5.87	6.00	7.13	....	....
4	6.00	6.00	7.28	$22.60	$22.60
1	7.29	6.99	8.85	$26.73	$25.77
5	6.88	6.59	8.35	....	....
1	6.68	6.59	8.11	....	....
2	7.47	6.59	9.07	....	....
7	6.38	6.59	7.75	....	....
2	6.30	6.59	7.65	....	....
1	6.48	6.59	7.87	....	....
1	6.06	6.59	7.36	....	....
1	6.12	6.59	7.43	....	....
2	6.16	6.59	7.48	....	....
3	6.09	6.59	7.40	....	....
1	6.17	6.59	7.50	....	....
26	6.44	6.59	7.81	$24.01	$24.49
1	6.62	6.17	8.04	....	....
3	6.25	6.17	7.59	....	....
5	6.49	6.17	7.88	....	....
2	6.56	6.17	7.96	....	....
1	6.80	6.17	8.26	....	....
2	5.90	6.17	7.17	....	....
7	5.99	6.17	7.27	....	....
1	6.01	6.17	7.30	....	....
22	6.33	6.17	7.68	$23.66	$23.14
1	6.22	5.76	7.56	....	....
1	5.59	5.76	6.79	....	....
2	5.91	5.76	7.18	$22.31	$21.83

COTTON

Manufacturer or Jobber and Brand	Station Number
Union Oil Company, **Monroe, La.**	
Cotton Seed Meal Fertilizer	1339
	1474
	1573
	1650
	2160
	1817
	1822
	1938
	2092
	1157
Average	
Union Oil Company, **Torras, La.**	
Cotton Seed Meal Fertilizer	1432
	1657
	2063
	1568
	1813
	1939
	2149
Average	
Union Oil Company, **Vidalia, La.**	
Cotton Seed Meal Fertilizer	1332
	1715
	2148
	1665
	1937
	2034
	2222
Average	

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
1	6.61	6.59	8.02	....	....
4	6.59	6.59	8.00	....	....
2	6.90	6.59	8.38	....	....
1	6.59	6.59	8.00	....	....
1	6.63	6 59	8.05	....	....
1	6.47	6.59	7.86	....	....
4	6.37	6.59	7.74	....	....
6	6.25	6.59	7.59	....	....
1	6.55	6.59	7.96	....	....
1	6.43	6.59	7.82	....	....
22	6.54	6.59	7.94	$24.33	$24.49
1	6.69	6.59	8.12	....	....
30	6.59	6.59	8.00	....	....
2	6.59	6.59	8.00	....	....
5	6.34	6.59	7.70	....	....
7	6.44	6.59	7.83	....	....
3	6.45	6.59	7.83	....	....
1	6 51	6.59	7.91	....	....
49	6.51	6.59	7.91	$24.23	$24.49
1	6.60	6.59	8.01	....	....
4	6.59	6.59	8.00	....	....
1	6.65	6.59	8.08	....	....
1	6.61	6.59	8.02	....	....
3	6.58	6.59	7.99	....	....
4	6.37	6.59	7.75	....	....
1	6.23	6.59	7.58	....	....
15	6.52	6.59	7.92	$24.26	$24.49

COTTON

Manufacturer or Jobber and Brand	Station Number
Washington Cotton and Oil Company,	
Washington, La.	
Cotton Seed Meal Fertilizer	1278 1326 1480 1745 1815 2080
Average	
Winona Oil and Manufacturing Company,	
Winona, Miss.	
Cotton Seed Meal Fertilizer	1827 2064
Average	
Woodville Oil and Manufacturing Company,	
Woodville, Miss.	
Cotton Seed Meal Fertilizer	2139

SEED MEAL.

Number of samples composited	NITROGEN		Ammonia Found %	Comparative Value Per Ton	
	Found %	Guarant'd %		Found	Guaranteed
9	6.55	6.00	7.96	....	....
6	6.53	6.00	7.93	....	....
3	6.25	6.00	7.59	....	....
1	6.42	6.00	7.79	....	....
1	6.46	6.00	7.85	....	....
2	6.71	6.00	8.16	....	....
22	6.49	6.00	7.88	$24.17	$22.60
1	6.18	6 58	7.50	....	....
3	6.26	6.58	7.61	....	....
4	6.22	6.58	7.56	$23.30	$24.46
2	6.11	5.75	7.43	$22.95	$21.80

CHEMICALS

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Caddo Fertilizer Company, Shreveport, La.		
Kainit	1608	1
	1718	1
	1992	1
	1754	1
Average		4
Hazlehurst Oil Mill and Fertilizer Company, Hazlehurst, Miss.		
German Kainit	1124	2
	1158	1
	1234	2
Average		5
Jackson Fertilizer Company, Jackson, Miss.		
German Kainit	1455	2
New Orleans Acid and Fertilizer Company, Gretna, La.		
Kainit	1084	1
	1123	1
	1369	3
Average		5
Muriate of Potash	1119	2
	1601	1
Average		3
Planters' Fertilizer and Chemical Company, New Orleans, La.		
Planters' Kainit	1603	3
	1122	1
Average		4
Muriate of Potash	1235	1

CHEMICALS

NITROGEN		Ammonia Found %	POTASH		Comparative Value Per Ton	
Found %	Guarant'd %		Found %	Guarant'd %	Found	Guaranteed
....	....	....	12.90	12.00	....	....
....	....	....	13.60	12.00	....	....
....	....	....	12.80	12.00	....	....
....	....	....	13.00	12.00	....	....
....	....	....	13.08	12.00	$10.46	$ 9.60
....	....	....	13.24	12.00	....	....
....	....	....	12.10	12.00	....	....
....	....	....	13.28	12.00	....	....
....	....	....	12.87	12.00	$10.30	$ 9.60
....	....	....	12.00	12.00	$ 9.60	$ 9.60
....	....	....	12.00	12.00	....	....
....	....	....	12.65	12.00	....	....
....	....	....	13.16	12.00	....	....
....	....	....	12.60	12.00	$10.08	$ 9.60
....	....	....	50.16	50.00	....	....
....	....	....	50.93	50.00	....	....
....	....	....	50.54	50.00	$40.43	$40.00
....	....	....	12.51	12.00	....	....
....	....	....	12.18	12.00	....	....
....	....	....	12.35	12.00	$ 9.88	$ 9.60
....	....	....	51.36	48.00	$41.09	$38.40

CHEMICALS

Manufacturer or Jobber and Brand	Station Number	Number of samples composited
Standard Chemical and Manufacturing Company, New Orleans, La.		
Kainit Imported	1118	2
	1264	1
	1456	3
	1602	6
	1686	5
Average		17
Muriate of Potash	1120	1
	2200	1
Average		2
Sulphate of Potash	1085	1
	1121	1
Average		2
Nitrate of Soda	1110	1
Nitrate of Soda	1109	1
	1416	1
	1742	2
	1973	1
Average		5
Swift Fertilizer Works, Atlanta, Ga.		
Swift's German Kainit	1610	1
Swift's Nitrate of Soda	1611	1
Virginia-Carolina Chemical Company, Shreveport, La.		
German Kainit	1192	1
	1609	2
	1719	1
	1755	1
Average		5

CHEMICALS

NITROGEN		Ammonia Found %	POTASH		Comparative Value Per Ton	
Found %	Guarant'd %		Found %	Guarant'd %	Found	Guaranteed
....	....	....	13.14	12.00	....	....
....	....	....	13.36	12.00	....	....
....	....	....	12.00	12.00	....	....
....	....	....	12.33	12.00	....	....
....	....	....	13.96	12.00	....	....
....	....	....	12.96	12.00	$10.37	$ 9.60
....	....	....	48.78	45.00	....	....
....	....	....	48.13	45.00	....	....
....	....	....	48.46	45.00	$38.77	$36.00
....	....	....	51.79	47.00	....	....
....	....	....	50.28	47.00	....	....
....	....	....	51.04	47.00	$40.83	$37.60
15.92	16.00	19.33	....	....	$50.94	$51.20
15.31	15.00	18.59	....	....	....	....
15.40	15.00	18.70	....	....	....	....
15.32	15.00	18.61	....	....	....	....
15.34	15.00	18.64	....	....	....	....
15.34	15.00	18.64	....	....	$49.09	$48.00
....	....	....	11.82	12.00	$ 9.46	$ 9.60
15.67	14.82	19.04	....	....	$50.14	$47.42
....	....	....	12.96	12.00	....	....
....	....	....	13.10	12.00	....	....
....	....	....	12.40	12.00	....	....
....	....	....	13.48	12.00	....	....
....	....	....	12.99	12.00	$10.39	$ 9.60

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OF THE

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BATON ROUGE.

ANALYSES
OF
COMMERCIAL FEEDING STUFFS

J. E. HALLIGAN, B. S.

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The Bulletins and Reports will be sent free of charge to all farmers, on application to the Director of the Stations, Baton Rouge, La.

COMMERCIAL FEEDING STUFFS.

J. E. Halligan.*

During the past season the following analyses of feed stuffs have been made at this Station:

Cotton seed meal	749
Rice bran	343
Rice polish	142
Wheat products	1,402
Molasses feeds	442
Corn chops	2,101
Corn and oat feeds	749
Hominy	42
Feed meal	65
Brewer's grains	46
Poultry feeds	323
Miscellaneous	65
Total analyses	6,469

For explanation of the terms protein, fat, carbohydrates, fiber, water and ash consult Bulletin 86 of this Station.

Copies of the Feed Stuff Law can be secured by applying to the Commissioner of Agriculture.

COTTON SEED MEAL.

The Inter-State Cotton Seed Crushers' Association at its meeting at Jamestown May 21-23, 1907, adopted the following as a standard classification for cotton seed meal:

Section 1.—Choice Cotton Seed Meal must be finely ground, perfectly sound and sweet in odor, yellow, free from excess of lint and hulls, and by analysis must contain at least 8 per cent of Ammonia (41.15 per cent protein).

Section 2.—Prime Cotton Seed Meal must be finely ground, of sweet odor, reasonably bright in color, yellow, not brown or reddish, and by analysis must contain at least 7 1-2 per cent of Ammonia (38.50 per cent protein).

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*With the assistance of H. L. Green, B. S.; J. C. Summers, B S.; R. Baus, B. S., and W. D. Morgan, B. S.

Section 3.—Good Cotton Seed Meal must be finely ground, of sweet odor, reasonably bright in color, and by analysis must contain at least 7 per cent of Ammonia (36 per cent protein).

Section 4.—Off Cotton Seed Meal. Any Cotton Seed Meal which is distinctly deficient in any of the requirements of prime quality, either in color, odor, texture or analysis, or all, shall be deemed Off Meal and should be sold by sample.

The meals in the following tables are classified according to the above standards except that the color and odor are not considered. There are some companies whose goods appear under more than one head. According to this classification, 490 meals analyzed choice, 185 prime, 39 good and 35 off.

There was a company which put out a meal that ran high in protein and low in fat. This meal was treated with naphtha to extract the oil and it showed a very fine mechanical condition.

RICE BRAN.

It is almost impossible to manufacture rice bran and eliminate all the hulls, but it is poor and objectionable business to add rice hulls to rice bran. This addition of hulls lowers the value of rice bran for feeding purposes and on account of this adulteration many of our feeders are afraid to purchase this valuable by-product. Many of our large mills have large quantities of rice hulls on hand and they seem to find it hard to dispose of these hulls without introducing them into rice bran.

I heard that the States of Wisconsin and Pennsylvania were opposed to the sale of rice bran in their respective States, so I wrote them regarding this. Both States permit the sale of rice bran. Mr. Woll, chemist of the Wisconsin Experiment Station, says in a special bulletin that Southern mills are continually sending circulars to our feed dealers and jobbers, tempting them to handle low-grade rice products. Mr. Fuller, chemist of the Department of Agriculture of the State of Pennsylvania, says that, while the sale of rice bran is not prohibited in Pennsylvania, it comes within the provisions of the Feeding Stuffs Law. He is of the opinion, however, that a prohibitory clause should be incorporated into the law.

DISCUSSION.

A good rice bran should contain 12.50 per cent of protein, 10 per cent of fat, not over 10 per cent of fiber and not over 9 per cent of ash, and it should not have a rancid odor. By perusing the analyses of rice brans in the following pages you will find very few brands up to the above standard. According to Dr. Browne, formerly chemist of the Louisiana Sugar Experiment Station, who made extensive investigations on rice products, the formula used for calculating adulteration in rice bran with hulls is as follows:

Per cent hulls=3.33x (per cent fiber—10), assuming that the hulls carry 40 per cent fiber and the bran runs 10 per cent fiber.

A sample of rice bran with 30 per cent fiber would be considered as having 66.60 per cent hulls.

Example: Per cent hulls=3.33x (30—10).
3.33x20=66.60 per cent.

The per cent of hulls given in this bulletin are figured by the above formula.

Many adulterated rice brans run up to their guarantee, yet they may be injurious to the digestive organs of the animal to which they are fed when the per cent of hulls is high.

Pure rice bran is a good feed and mill men are injuring future business by flagrant adulteration. Great care should be exercised in purchasing rice bran. This feed can be purchased from $12 to $14 per ton at the mills.

RICE POLISH.

There were 142 samples of rice polish examined during the past season. Some of the samples contained grits and hulls.

When the percentage of grits is high the digestibility of the feed is lowered, as many of the grits pass through the animal undigested. A rice polish should contain 11 per cent of protein, 7 per cent of fat, 65 per cent of carbohydrates, 1-2 per cent of fiber and 3-5 per cent of ash.

Most of the rice mills sell this feed for $20 a ton.

WHEAT PRODUCTS.

Under this head come wheat bran, wheat middlings—sometimes called shorts—wheat mixed feed, which is a mixture of wheat bran and wheat middlings in varying proportions, and shipstuff, which is generally a finely ground wheat product and is sometimes adulterated with ground corn cobs, corn bran, oat hulls, etc.

There were a few samples of wheat bran adulterated with corn bran, oat hulls, light oats and weed seeds. Some samples contained screenings.

There are some wheat feeds put out under trade names, and, while they reached their guarantees, in many cases, the consumer in buying these feeds pays fully as much as for the pure article. Many of these wheat feeds are so finely ground that it is impossible to detect adulteration with the naked eye. The purchaser should demand a guarantee of 15 per cent of protein on wheat bran, 17 per cent of protein on wheat middlings and 16 per cent of protein on wheat mixed feed. Any wheat feeds carrying less than the above standards should be avoided. There are some wheat feeds reported in the following pages that run as low as 10 per cent protein.

MOLASSES FEEDS.

There was a large quantity of this class of goods consumed in this State during the past season. Some of the samples showed poor mechanical mixture. It is necessary for the manufacturer to dry these feeds sufficiently to prevent decomposition. There were a few shipments where fermentation set in and spoiled the feed. Most of the molasses feeds found on our market are of good quality. The analyses of these feeds show a variation of 6.13 per cent to 22.31 per cent protein, 0.54 per cent to 8.22 per cent fat, 5.80 per cent to 20.86 per cent fiber and 8.03 per cent to 17.15 per cent water.

The feeder should avoid shipments that are not in a good mechanical condition and feeds that smell rancid and contain over 12 per cent of moisture.

CORN CHOPS.

There were 2,101 shipments of corn chops analyzed during the past season. Some of the samples were adulterated with corn cobs and many of these feeds were composed of very inferior corn. There were a few samples that showed signs of previous fermentation. A sample of bright sweet corn chops and a sample that was fermented were analyzed to find out if a chemical analysis would show this fermented condition. No. 1—Bright, sweet sample: No. 2—Fermented sample.

	Protein.	Fat.	Carbohydrates.	Fiber.	Water.	Ash.
No. 1	8.63	3.61	73.90	1.93	10.52	1.41
No. 2	8.81	3.41	73.39	2.15	10.95	1.29

The above analyses show that in this case the chemical analysis did not indicate whether or not the corn chops was fermented.

The addition of corn cobs lowers the protein and fat and increases the fiber. Corn chops should carry 9 per cent of protein and they should be dry, clean, should smell sweet and should be free from fermentation and adulteration.

CORN AND OAT FEEDS.

These feeds are made of mixtures of factory by-products or waste products. Some of the brands are fortified with dried brewers' grains, alfalfa, gluten feed and other substances to bring up their protein content. These feeds seem to find a ready market in Louisiana. Some of the samples failed to meet their guarantees. The results reported in the following tables show that these feeds vary from 6.50 per cent to 15.60 per cent of protein, from 2.05 per cent to 6.80 per cent of fat, and from 6.69 per cent to 24.25 per cent of fiber.

The purchaser should demand a feed containing not less than 9 per cent protein, 3.50 per cent fat, and it should not contain over 14 per cent fiber.

BREWERS' GRAINS.

Dried brewers' grains are the kiln dried by-product from the manufacture of beer. This feed is unpopular in Louisiana, as some of the feeders think that rice hulls may be present. The samples received in this laboratory were free from rice hulls and were of good quality. This feed should contain 22 per cent of protein, 5 per cent of fat and not over 16 per cent of fiber. According to experiments conducted at the Massachusetts Experiment Station brewers' grains are an economical and satisfactory protein concentrate for cattle and for horses.

The samples analyzed this year run from 19.31 per cent to 28.44 per cent of protein, from 5.78 per cent to 7.37 per cent of fat, from 38.31 per cent to 45.52 per cent of carbohydrates and from 12.94 per cent to 17.90 per cent of fiber.

POULTRY FEEDS.

The several poultry feeds are composed of mixtures of corn (whole or cracked), wheat, wheat by-products, oats, oat refuse, cotton seed meal, linseed meal, ground alfalfa, clover, peas, millet seeds. rye, sunflower seeds, barley, weed seeds, animal by-products, sweepings, shells, charcoal and other waste products. When the per cent of ash runs high it is generally due to the presence of grit or shells. A poultry feed should contain not less than 10 per cent of protein and 3 per cent of fat, and it should not run over 6 per cent of ash. It should be free from shells, grit and weed seeds. The purchaser should demand a feed that smells sweet and shows a good, clean appearance.

The following table may be found useful in compounding rations:

Feed—	One quart weighs	One pound measures
Cotton Seed Meal	1.5 lbs.	0.7 qts.
Brewers' Grains (Dried)	0.6 "	1.7 "
Wheat Middlings (Flour)	1.2 "	0.8 "
Wheat Middlings (Standard)	0.8 "	1.3 "
Wheat Mixed Feed	0.6 "	1.7 "
Wheat Bran	0.5 "	2.0 "
Whole Oats	1.0 "	1.0 "
Ground Oats	0.7 "	1.4 "
Whole Wheat	1.9 "	0.5 "
Ground Wheat	1.7 "	0.6 "
Whole Corn	1.7 "	0.6 "
Corn Meal	1.5 "	0.7 "
Corn and Cob Meal	1.4 "	0.7 "
Corn Bran	0.5 "	2.0 "
Hominy Meal	1.1 "	0.9 "
Corn and Oat Feed (Victor)	0.7 "	1.4 "
Whole Barley	1.5 "	0.7 "
Barley Meal	1.1 "	0.9 "
Whole Rye	1.7 "	0.6 "
Rye Meal	1.5 "	0.7 "
Rice Bran	0.8 "	1.3 "
Rice Polish	1.2 "	0.8 "
Molasses (Blackstrap)	3.0 "	0.3 "

Much of the data in the above table was compiled by the Massachusetts Experiment Station.

A Table showing the Standards of Feed Stuffs found on the Louisiana market, arranged according to their Protein Content.

NAME OF FEED	PROTEIN	FAT	Carbo-hydrates	FIBER	ASH
Cotton Seed Meal (choice)	41.15	7–10	23–27	6–8	6.20–7.50
Cotton Seed Meal (prime)	38.50–41.15	7–10	23–27	6–8	6.20–7.50
Cotton Seed Meal (good)	36–38.50	7–10	27	9–12	6–7
Cotton Seed Meal (off)	17–36	4.50–10	27–31	20–25	5
Brewers' Grains (dried)	22	5–7.40	40–45	12.50–16.00	3–4.30
Wheat Middlings (Shorts)	17–19	5	55	7	4–4.50
Wheat Mixed Feed	16–18	4	55	8	5
Wheat Bran	15–17	4	53	10	6
Alfalfa Meal	15	1.5–4	33	25	9–10
Rye Feed	14.8	2.8	64	4	3
Rice Bran (good quality)	12.50	8–10	49	10	9
Oats	11	4	59	8–10	3–3.50
Barley	11	1.7	66	6	2–3
Rice Polish	11	7	65	1–2	3–5
Hominy Meal	10	7.5	64	4–5	2.5
Rice Bran (16% hulls)	9.8	9.9	44	14.8	11.4
Feed Meal	9.50	6.80	63.50	3–6	2–3
Corn Chops	9.00	3.50	72	2	1.30
Corn Bran	9	4.50	60	11	2
Corn and Oat Feed	7.50–10	3–5	60	10–17	3–5
Cotton Seed Hulls	4–6	2–3	33	40–46	2.8
Molasses (Blackstrap)			65.9		9.3
POULTRY FEEDS—					
Blood Meal	84				
Beef Scraps	60	9.50			
Meat and Bone Meal	40	10			
Bone Meal	26				
Mash	15	4			6
Scratching Grains	10	3	60		6

Table Showing Results of Analyses of Feed Stuffs and Approxi of the Experiment Sta

NAME OF FEED	Carbohydrates in Pounds		PROTEIN in Pounds	
	Amount	Valuation at 1c per lb.	Amonnt	Valuation at 2½c per lb
Alfalfa Hay	42.70	$0.43	14.30	$0.35
Bermuda grass hay	51.00	0.51	10.70	0.27
Brewers' grains	45.60	0.46	23.50	0.59
Corn	70.40	0.70	10.30	0.26
Cow pea hay	41.20	0.41	14.40	0.36
Crab grass hay	41.00	0.41	6.90	0.18
Cotton seed	24.70	0.25	18.40	0.46
Cotton seed meal (high grade)	23.10	0.23	44.00	1.10
Cotton seed meal (medium grade)	26.40	0.26	39.00	0.97
Cotton seed meal (low grade)	30.30	0.30	25.80	0.65
Hominy chops	64.50	0.65	9.80	0.25
Lespedeza hay	39.00	0.39	13.80	0.35
Timothy hay	45.00	0.45	5.90	0.15
Molasses (blackstrap)	65.90	0.66	.....	.....
Oats	59.70	0.60	11.80	0.29
Peanut hay	42.70	0.43	10.70	0.27
Rice bran (15 per cent hulls)	44.50	0.45	9.90	0.25
Rice polish	64.30	0.64	11.10	0.28
Rough rice	64.30	0.64	7.40	0.18
Wheat bran	53.90	0.54	15.40	0.38
Shorts	60.40	0.60	15.60	0.39
Sorghum silage	15.30	0.15	0.80	0.02
Sugar beet	10.50	0.11	1.60	0.04
Sweet potatoes	24.70	0.25	1.50	0.04
Corn silage	11.00	0.11	1.70	0.04

mate Comparative Valuations Made at the Chemical Laboratory tion, Baton Rouge, La.

FAT in Pounds		DIGESTIBLE FIBER in Pounds.		TOTAL VALUATION Per	
Amount	Valuation at 2½c per lb	Amount	Valuation at 1c per lb.	100 Lbs.	Ton
2.20	$0.06	10.70	$0.11	$0.95	$19.00
2.90	0.07	.....	.....	0.85	17.00
5.50	0.14	5.90	0.06	1.25	25.00
5.00	0.13	1.30	0.01	1.10	22.00
2.50	0.07	9.20	0.09	0.84	16.80
1.60	0.04	21.20	0.21	0.84	16.80
19.90	0.50	17.60	0.18	1.39	27.80
8.00	0.20	.....	.....	1.53	30.60
7.80	0.19	.....	.....	1.42	28.40
6.90	0.17	.....	.....	1.12	22.40
8.30	0.21	.....	.....	1.11	22.20
3.70	0.09	12.30	0.12	0.95	19.00
2.50	0.06	15.10	0.15	0.81	16.20
....	.....	.....	....	0.66	13.20
5.00	0.13	2.80	0.03	1.05	21.00
4.60	0.12	12.30	0.12	0.94	18.80
9.90	0.25	1.90	0.02	0.97	19.40
5.80	0.14	0.80	0.08	1.07	21.40
2.60	0.07	2.00	0.02	0.91	18.20
4.00	0.10	....	....	1.02	20.40
4.00	0.10	1.70	0.02	1.11	22.20
0.30	0.01	....	....	0.18	3.60
0.10	0.00	0.90	0.01	0.16	3.20
0.40	0.01	....	....	0.30	6.00
0.80	0.02	3.70	0.04	0.21	4.20

Table showing Results of Analyses of Feed Stuffs and Approxi of the Experiment Sta

NAME OF MANUFACTURER	BRAND
Valley Milling Co.	Delta
Ralston Purina Co	Purina
American Cereal Co	Victor corn and oats
The Great Western Cereal Co	Boss corn and oats
Ralston Purina Co	Good Luck
Ralston Purina Co	Peerless feed
Corno Mills Co	Corno chick feed
Ralston Purina Co	Scratch size
The Valley Milling Co	Acme chicken
B. F. Glover & Son Com. Co	N. B. chicken feed
The Corno Mills Co.	Corno H. & M.
Ralston Purina Co	Protena dairy
The Corno Mills Co	Creamo dairy
Ralston Purina Co	Protena alfalfa feed
Ralston Purina Co	Peerless alfalfa feed
Alfalfa Product Co	Alfalfa lass
Lawrence & Hamilton	Stafolife
Nutriline Feed & Oil Co	Nutriline dairy
Nutriline Feed & Oil Co	Nutriline stock feed
American Milling Co	Sucrene dairy feed
Atlas Feed Pro. & Milling Co	Sugar feed

mate Comparative Valuations Made at the Chemical Laboratory
tion, Baton Rouge, La.

Carbohydrates in Pounds		PROTEIN in Pounds		FAT in Pounds		FIBER in Pounds Amount	Total Valuation per	
Amount	Valuation at 1c per lb.	Amount	Valuation at 2½c per lb	Amount	Valuation at 2½c per lb		100 Lbs.	Ton
61.50	$0.62	8.00	$0.20	4.00	$0.10	12.50	$0.92	$18.40
59.60	0.60	14.00	0.35	4.80	0.12	8.00	1.07	21.40
62.20	0.62	8.00	0.20	3.20	0.08	11.50	0.90	18.00
62.30	0.62	8.20	0.21	4.00	0.10	10.50	0.93	18.60
57.00	0.57	11.20	0.28	3.30	0.08	12.00	0.93	18.60
54.30	0.54	8.40	0.22	2.90	0.07	15.20	0.83	16.60
70.20	0.70	10.50	0.26	3.00	0.07	3.50	1.03	20.60
69.50	0.70	10.20	0.26	3.10	0.08	3.50	1.04	20.80
60.20	0.60	8.50	0.21	2.90	0.07	3.90	0.88	17.60
65.00	0.65	9.50	0.24	3.50	0.09	6.50	0.98	19.60
58.10	0.58	9.30	0.23	3.20	0.08	13.30	0.89	17.80
40.00	0.40	20.10	0.50	5.50	0.14	16.20	1.04	20.80
51.20	0.51	13.30	0.34	2.90	0.07	20.00	0.92	18.40
56.50	0.57	10.50	0.26	3.30	0.08	12.50	0.91	18.20
58.50	0.59	11.20	0.28	3.20	0.08	12.30	0.95	19.00
43.00	0.43	12.50	0.32	0.90	0.02	19.50	0.77	15.40
52.00	0.52	11.30	0.28	5.50	0.14	10.50	0.94	18.80
45.50	0.46	18.50	0.46	7.50	0.19	8.90	1.11	22.20
55.20	0.55	14.50	0.36	7.00	0.18	6.50	1.09	21.80
47.60	0.48	18.20	0.45	5.30	0.13	12.20	1.06	21.20
52.80	0.53	8.00	0.20	2.50	0.06	12.50	0.79	15.80

CHOICE COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Abbeville Cotton Oil Co.,	1	655	55.38	*43.00*
Abbeville, La.	1	1004	45.50	*43.00*
Cotton Seed Meal.	2	1306	45.19	*43.00*
	1	1843	45.00	*43.00*
Average	5		47.78	*43.00*
Arcadia Cotton Oil Mill & Mfg. Co.,	2	808	44.31	*42.00*
Arcadia, La.	3	1289	45.19	*42.00*
	3	1117	44.25	*42.00*
Arcadia.	1	1856	43.63	*42.00*
Average	9		44.34	*42.00*
Arkansas Valley Cotton Oil Co.,	1	1857	44.16	*38.75*
Dardanelle, Ark.				
Cotton Seed Meal Feed.				
Centerville Cotton Oil Co.,	2	756	43.19	*38.75*
Centerville, Miss.	1	1073	43.19	*38.75*
Cotton Seed Meal.				
Average	3		43.19	*38.75*
Cinclare Cotton Oil Co.,				
Cinclare, La.	1	818	43.25	*35.00*
Cotton Seed Meal.	1	1210	43.88	*35.00*
	1	1747	41.09	*35.00*
Average	3		42.74	*35.00*
Clay County Cotton Oil Co.,				
West Point, Miss.	4	939	43.69	*41.00*
Cotton Seed Meal.	4	1031	43.91	*41.00*
Average	8		43.80	*41.00*
Cotton Seed Meal	2	1025	42.94	*38.75*
	1	896	40.56	*38.75*
Average	3		41.75	*38.75*

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* The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
2.09	*12.00*	14.02	*20.00*	10.68	*4.00*	9.72	8.11
12.41	*12.00*	20.25	*20.00*	7.87	*4.00*	8 29	5.68
9.53	*12.00*	22.41	*20.00*	9.09	*4.00*	7.96	5.82
11.00	*12.00*	21.60	*20.00*	8.55	*4.00*	7.97	5.88
8.76	*12.00*	19.57	*20.00*	9.04	*4.00*	8.48	6.37
8.68	*8.00*	24.22	*15.00*	6.64	*10.00*	9.48	6.67
8.62	*8.00*	23.00	*15.00*	9.00	*10.00*	7.58	6.61
8.98	*8.00*	23.10	*15.00*	7.82	*10.00*	9.18	6.67
7.35	*8.00*	23.72	*15.00*	9.30	*10.00*	9.00	7.00
8.41	*8.00*	23.26	*15.00*	8.19	*10.00*	9.06	6.74
9.70	*8.00*	24.41	*25.00*	6.05	*9.50*	8.65	7.03
8.27	*8.20*	26.14	*25.00*	7.34	*9.50*	8.74	6.32
10.67	*8.20*	23.00	*25.00*	8.95	*9.50*	7.55	6.64
9.47	*8.20*	24.57	*25.00*	8.15	*9.50*	8.14	6.48
9.43	*8.00*	23.49	*20.00*	7.05	*10.00*	9.19	7.59
9.92	*8.00*	22.47	*20.00*	8.61	*10.00*	7.58	7.54
7.81	*8.00*	24.46	*20.00*	11.53	*10.00*	8.13	6.98
9.06	*8.00*	23.47	*20.00*	9.06	*10.00*	8.30	7.37
9.70	*8.00*	22.71	*25.00*	8.90	*8.00*	8.36	6.64
9.92	*8.00*	23.69	*25.00*	8.65	*8.00*	6.98	6.85
9.81	*8.00*	23.20	*25.00*	8.78	*8.00*	7.67	6.74
9.17	*8.00*	24.24	*25.00*	9.23	*9.50*	7.27	7.15
9.17	*8.00*	26.22	*25.00*	8.42	*9.50*	9.01	6.62
9.17	*8.00*	25.23	*25.00*	8.83	*9.50*	8.14	6.88

CHOICE COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed.
Conway Cotton Oil & Gin Co., **Conway, Ark.** Cotton Seed Meal Feed.	3	907	45.19	*40.00*
Cotton Seed Meal Feed.	2	910	44.81	*44.00*
DeSoto Cotton Oil Co.,	1	1988	42.75	*41.89*
Mansfield, La.	2	781	39.43	*41.89*
Cotton Seed Meal.	1	1840	43.44	*41.89*
	3	1459	42.00	*41.89*
	3	1094	44.31	*41.89*
Average	10		42.39	*41.89*
Hazlehurst Oil Mill & Fertilizer Co.,	3	646	40.50	*40.00*
Hazlehurst, Miss.	13	858	45.75	*40.00*
Imperial Cotton Seed Feed Meal.	21	924	41.94	*40.00*
	19	978	46.88	*40.00*
	17	1113	45.44	*40.00*
	5	1159	44.75	*40.00*
	14	1276	44.87	*40.00*
	4	1351	45.19	*40.00*
	6	1429	41.13	*40.00*
	9	748	44.59	*40.00*
	17	1561	44.69	*40.00*
	2	1669	46.56	*40.00*
	13	1876	43.06	*40.00*
	9	1770	44.81	*40.00*
	2	2053	45.31	*40.00*
	5	2102	39.75	*40.00*
Average	159		44.07	*40.00*
Hope Cotton Oil Co.,	7	1148	46.75	*41.00*
Hope, Ark.	2	1319	46.63	*41.00*
Cotton Seed Meal Feed.				
Average	9		46.69	*41.00*
Cotton Seed Meal Feed.	3	1805	45.15	*38.75*
Independent Cotton Oil Co., **Columbus, Miss.** Cotton Seed Meal.	1	1212	42.34	*38.00*

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* The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed.	% Found	% Found
11.69	*9.00*	22.50	*26.00*	5.25	*8.00*	8.39	6.98
11.60	*9.00*	22.30	*27.00*	5.14	*7.50*	9.23	6.92
8.95	*8.02*	23.51	*23.16*	8.85	*10.55*	9.65	6.29
9.42	*8.02*	25.75	*23.16*	9.77	*10.55*	9.72	5.91
8.86	*8.02*	24.27	*23.16*	9.00	*10.55*	7.73	6.70
9.64	*8.02*	24.56	*23.16*	8.55	*10.55*	8.87	6.38
9.08	*8.02*	23.27	*23.16*	7.97	*10.55*	8.43	6.94
9.19	*8.02*	24.27	*23.16*	8.83	*10.55*	8.88	6.44
7.36	*8.00*	25.22	*24.00*	11.14	*5.00*	9.22	6.56
8.58	*8.00*	21.14	*24.00*	9.10	*5.00*	9.23	6.20
8.44	*8.00*	24.31	*24.00*	10.56	*5.00*	8.56	6.19
8.02	*8.00*	23.20	*24.00*	6.66	*5.00*	8.84	6.40
8.61	*8.00*	23.13	*24.00*	8.29	*5.00*	8.09	6.44
8.13	*8.00*	23.30	*24.00*	8.55	*5.00*	8.91	6.36
9.94	*8.00*	22.05	*24.00*	9.52	*5.00*	7.10	6.52
10.18	*8.00*	20.53	*24.00*	8.76	*5.00*	8.57	6.77
8.90	*8.00*	23.95	*24.00*	10.18	*5.00*	9.31	6.53
8.50	*8.00*	26.69	*24.00*	6.55	*5.00*	7.35	6.32
8.98	*8.00*	22.12	*24.00*	8.56	*5.00*	9.23	6.42
6.72	*8.00*	25.83	*24.00*	6.32	*5.00*	8.29	6.28
8.90	*8.00*	22.89	*24.00*	9.55	*5.00*	9.50	6.10
8.73	*8.00*	22.69	*24.00*	9.62	*5.00*	7.65	6.50
9.11	*8.00*	21.95	*24.00*	8.10	*5.00*	9.27	6.26
11.16	*8.00*	22.77	*24.00*	10.48	*5.00*	9.62	6.22
8.76	*8.00*	23.25	*24.00*	8.87	*5.00*	8.67	6.38
8.61	*10.00*	24.09	*27.00*	4.90	*8.00*	8.46	7.19
8.56	*10.00*	23.72	*27.00*	5.67	*8.00*	8.23	7.19
8.59	*10.00*	23.90	*27.00*	5.28	*8.00*	8.35	7.19
9.10	*8.00*	24.87	*25.00*	6.28	*9.50*	7.77	6.83
9.14	*8.00*	25.25	*25.00*	8.67	*9.00*	7.84	6.76

CHOICE COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guar-anteed
Josey Miller Co., **Beaumont, Texas.** Cotton Seed Meal Feed.	1	1975	49.00	*49.18*
	1	1733	47.40	*49.18*
Average	2		48.20	*49.18*
Kentwood Oil Mill & Mfg. Co., **Kentwood, La.** Cotton Seed Meal.	4	875	41.37	*40.00*
	1	1484	45.56	*40.00*
	6	699	42.31	*40.00*
Average	11		43.08	*40.00*
LeCompte Cotton Oil Co., Ltd., **LeCompte, La.** Cotton Seed Meal.	5	941	43.94	*42.93*
	4	1118	44.06	*42.93*
Average	9		44.00	*42.93*
Lexington Compress & Oil Co., **Lexington, Miss.** Cotton Seed Meal.	1	899	41.81	*38.75*
Little River Cotton Oil Co., **Ashdown, Ark.** Cotton Seed Meal.	1	1746	45.71	*38.41*
	1	1206	44.75	*38.41*
	2		45.23	*38.41*
Louisiana Cotton Oil Co., **Shreveport, La.** Cotton Seed Meal Feed.	1	852	43.50	*40.00*
	16	1000	42.94	*40.00*
	10	1139	43.50	*40.00*
	9	1252	44.13	*40.00*
	6	1635	43.81	*40.00*
	5	1430	42.88	*40.00*
	4	1499	42.63	*40.00*
	1	1959	45.25	*40.00*
Average	52		43.58	*40.00*

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* The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
9.85	*12.38*	20.28	*15.81*	5.63	*5.86*	9.10	6.14
12.25	*12.38*	22.26	*15.81*	4.82	*5.86*	6.97	6.30
11.05	*12.38*	21.27	*15.81*	5.23	*5.86*	8.03	6.22
11.77	*8.00*	24.26	*25.00*	6.35	*3.00*	9.73	6.52
10.98	*8.00*	20.53	*25.00*	6.57	*3.00*	9.77	6.59
12.07	*8.00*	25.55	*25.00*	5.79	*3.00*	7.98	6.30
11.61	*8.00*	23.44	*25.00*	6.24	*3.00*	9.16	6.47
12.13	*9.05*	22.61	*26.83*	5.96	*7.80*	7.93	7.43
10.50	*9.05*	22.66	*26.83*	6.01	*7.80*	9.39	7.38
11.31	*9.05*	22.63	*26.83*	5.99	*7.80*	8.66	7.41
11.37	*8.00*	22.47	*25.00*	8.59	*9.50*	9.08	6.68
8.48	*8.90*	25.39	*25.35*	5.75	*9.12*	7.94	6.73
8.32	*8.90*	26.35	*25.35*	6.25	*9.12*	7.14	7.19
8.40	*8.90*	25.87	*25.35*	6.00	*9.12*	7.54	6.96
11.01	*9.40*	23.02	*26.60*	6.37	*9.00*	8.97	7.13
9.81	*9.40*	22.89	*26.60*	8.76	*9.00*	8.26	7.34
9.28	*9.40*	24.97	*26.60*	7.71	*9.00*	7.10	7.44
10.48	*9.40*	23.84	*26.60*	6.91	*9.00*	7.03	7.61
8.61	*9.40*	24.22	*26.60*	8.15	*9.00*	8.17	7.04
11.11	*9.40*	22.43	*26.60*	7.04	*9.00*	9.35	7.19
8.66	*9.40*	23.09	*26.60*	9.45	*9.00*	9.15	7.02
6.13	*9.40*	24.93	*26.60*	6.75	*9.00*	9.45	7.49
9.39	*9.40*	23.67	*26.60*	7.64	*9.00*	8.44	7.28

CHOICE COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Magnolia Oil Mill & Mfg. Co., **Magnolia, Miss.** Cotton Seed Meal.	1	822	41.81	*40.00*
	2	988	46.81	*40.00*
	4	1362	44.87	*40.00*
	4	1457	44.81	*40.00*
	2	1652	44.50	*40.00*
	2	1911	44.38	*40.00*
	1	2055	45.19	*40.00*
Average	16		44.62	*40.00*
Minden Cotton Oil and Ice Co., **Minden, La.** Cotton Seed Meal Feed.	4	1036	45.06	*40.00*
	3	1311	45.31	*40.00*
	2	1468	42.46	*40.00*
Average	9		44.28	*40.00*
Natchez Oil Co., **Natchez, Miss.** Cotton Seed Meal.	1	1737	44.37	*41.00*
	5	698	41.19	*41.00*
	6	1168	43.19	*41.00*
	1	1208	45.81	*41.00*
	4	1395	43.25	*41.00*
Average	17		43.56	*41.00*
New Orleans Cotton Oil Co., **New Orleans, La.** Cotton Seed Meal.	1	1012	43.88	*40.00*
	3	1324	44.31	*40.00*
Average	4		44.09	*40.00*
Nutriline Feed and Oil Co., **Crowley, La.** Cotton Seed Meal. (Extracted with naptha.)	3	1549	47.43	*42.00*
People's Cotton Oil Co., **Lafayette, La.** Cotton Seed Meal Feed.	1	1062	44.87	*41.25*
	1	1385	41.13	*41.25*
	3	737	44.69	*41.25*
Average	5		43.56	*41.25*

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* The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
8.41	*8.00*	27.27	*26.00*	7.27	*8.00*	9.44	5.80
8.54	*8.00*	22.45	*26.00*	7.12	*8.00*	8.79	6.29
9.18	*8.00*	23.10	*26.00*	8.76	*8.00*	7.50	6.59
9.32	*8.00*	21.68	*26.00*	8.38	*8.00*	9.24	6.57
9.89	*8.00*	24.99	*26.00*	8.18	*8.00*	6.08	6.36
9.43	*8.00*	21.88	*26.00*	8.45	*8.00*	9.35	6.51
9.26	*8.00*	21.81	*26.00*	8.98	*8.00*	8.60	6.16
9.16	*8.00*	23.31	*26.00*	8.16	*8.00*	8.43	6.32
10.64	*7.50*	23.62	*20.00*	6.37	*7.50*	7.44	6.87
8.87	*7.50*	23.54	*20.00*	8.06	*7.50*	7.68	6.54
10.18	*7.50*	22.58	*20.00*	8.24	*7.50*	9.26	7.28
9.90	*7.50*	23.25	*20.00*	7.55	*7.50*	8.13	6.89
8.93	*9.00*	23.50	*27.00*	7.67	*7.50*	8.08	7.45
8.85	*9.00*	27.88	*27.00*	5.86	*7.50*	8.72	7.50
9.35	*9.00*	22.70	*27.00*	7.69	*7.50*	9.42	7.65
10.47	*9.00*	20.84	*27.00*	8.49	*7.50*	7.40	6.99
10.40	*9.00*	22.13	*27.00*	7.49	*7.50*	9.28	7.45
9.60	*9.00*	23.41	*27.00*	7.45	*7.50*	8.58	7.40
8.31	*8.00*	23.10	*26.00*	9.59	*8.00*	8.31	6.81
7.98	*8.00*	23.33	*26.00*	9.65	*8.00*	8.59	6.14
8.15	*8.00*	23.22	*26.00*	9.62	*8.00*	8.45	6.47
4.54	*3.00*	25.38	*25.00*	5.90	*10.00*	10.19	6.56
8.75	*13.98*	23.83	*23.73*	8.40	*9.52*	8.12	6.03
9.38	*13.98*	26.19	*23.73*	7.34	*9.52*	9.63	6.33
11.04	*13.98*	22.07	*23.73*	7.85	*9.52*	8.36	5.99
9.72	*13.98*	24.04	*23.73*	7.86	*9.52*	8.70	6.12

CHOICE COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed.
Pickens Cotton Oil Co., **Pickens, Miss.** Cotton Seed Meal Feed.	3	759	41.81	*38.75*
Ruston Oil Mill & Fertilizer Co.,	7	744	43.00	*41.00*
Ruston, La.	7	857	43.38	*41.00*
Cotton Seed Meal.	5	936	44.19	*41.00*
	16	1100	44.06	*41.00*
	1	1742	43.06	*41.00*
	1	1955	42.69	*41.00*
Average	37		43.40	*41.00*
Standard Cotton Seed Oil Co.,	1	660	48.22	*40.00*
New Orleans, La.	4	912	44.38	*40.00*
	2	758	39.63	*40.00*
Cotton Seed Meal.	1	1214	41.31	*40.00*
	1	1605	40.88	*40.00*
Average	9		42.88	*40.00*
Standard Guano and Chemical Mfg. Co., **New Orleans, La.** Cotton Seed Meal.	2	1381	42.13	*40.00*
Starksville Cotton Oil Co., **Starksville, Miss.** Cotton Seed Meal Feed.	1	1220	44.83	*38.75*
Stroud Cotton Oil Co.,	3	1640	44.56	*38.00*
Stroud, Okla.	1	1839	41.81	*38.00*
Cotton Seed Meal Feed.	1	2056	43.25	*38.00*
	1	2167	42.43	*38.00*
Average	6		43.01	*38.00*
St. Landry Cotton Oil Co.,	4	1251	42.13	*40.00*
Opelousas, La.	5	944	39.06	*40.00*
Cotton Seed Meal.	1	844	44.94	*40.00*
Average	10		42.04	*40.00*

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* The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Found
8.20	*8.20*	25.10	*25.00*	6.47	*9.50*	11.11	7.31
8.95	*10.00*	24.85	*27.00*	8.55	*8.00*	8.30	6.35
9.92	*10.00*	24.03	*27.00*	7.61	*8.00*	8.85	6.21
8.28	*10.00*	22.77	*27.00*	9.87	*8.00*	8.57	6.32
8.51	*10.00*	23.23	*27.00*	8.86	*8.00*	8.84	6.50
9.65	*10.00*	24.38	*27.00*	8.89	*8.00*	7.79	6.23
5.80	*10.00*	24.37	*27.00*	10.10	*8.00*	10.50	6.54
8.52	*10.00*	23.94	*27.00*	8.98	*8.00*	8.81	6.35
9.70	*8.00*	21.92	*26.00*	5.21	*8.00*	8.42	6.53
10.54	*8.00*	20.83	*26.00*	8.77	*8.00*	8.78	6.70
10.06	*8.00*	27.55	*26.00*	8.06	*8.00*	8.73	5.97
10.40	*8.00*	23.93	*26.00*	9.20	*8.00*	8.64	6.52
10.50	*8.00*	24.21	*26.00*	8.74	*8.00*	8.39	7.28
10.24	*8.00*	23.69	*26.00*	8.00	*8.00*	8.59	6.60
10.47	*8.00*	23.00	*26.00*	8.09	*8.00*	8.63	7.68
8.09	*8.20*	24.34	*25.00*	8.03	*9.50*	7.95	6.76
10.05	*8.00*	25.18	*25.00*	6.42	*9.00*	7.38	6.41
9.85	*8.00*	26.14	*25.00*	7.92	*9.00*	7.88	6.40
9.92	*8.00*	24.96	*25.00*	6.43	*9.00*	9.19	6.25
9.39	*8.00*	26.23	*25.00*	6.91	*9.00*	9.00	6.04
9.80	*8.00*	25.63	*25.00*	6.92	*9.00*	8.36	6.28
9.59	*8.50*	24.30	*24.00*	9.59	*10.50*	8.27	6.12
12.55	*8.50*	22.89	*24.00*	11.30	*10.50*	8.47	5.73
9.41	*8.50*	24.06	*24.00*	6.61	*10.50*	9.08	5.90
10.51	*8.50*	23.75	*24.00*	9.16	*10.50*	8.60	5.91

CHOICE COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Sunset Cotton Oil Co., **Sunset, La.** Cotton Seed Meal.	1	812	39.50	*40.00*
	3	977	44.31	*40.00*
	3	1188	43.56	*40.00*
	1	1589	42.69	*40.00*
Average	8		42.52	*40.00*
Swaffield Murphy Com. Co., **New Orleans, La.** Cotton Seed Meal.	1	1736	42.00	*38.00*
	1	1734	41.50	*38.00*
Average	2		41.75	*38.00*
The Union Oil Co., **Gretna, La.** Cotton Seed Meal.	3	749	42.37	*41.00*
	5	864	41.38	*41.00*
	2	1391	47.00	*41.00*
	3	1104	44.69	*41.00*
	1	1950	45.81	*41.00*
	1	2062	48.68	*41.00*
	15		44.99	*41.00*
The Union Oil Co., **Shreveport, La.** Cotton Seed Meal Feed.	1	2165	42.00	*41.00*
	11	715	41.06	*41.00*
	15	961	42.43	*41.00*
	7	1182	43.38	*41.00*
	4	1471	41.44	*41.00*
	3	1625	43.38	*41.00*
	3	1904	39.81	*41.00*
	3	2031	42.56	*41.00*
Average	47		42.00	*41.00*

*The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
12.52	*8.00*	26.15	*26.00*	6.89	*8.00*	9.15	5.79
11.57	*8.00*	22.18	*26.00*	7.16	*8.00*	8.85	5.93
10.40	*8.00*	24.05	*26.00*	7.66	*8.00*	8.11	6.22
12.36	*8.00*	22.45	*26.00*	7.89	*8.00*	8.77	5.84
11.71	*8.00*	23.70	*26.00*	7.40	*8.00*	8.72	5.95
8.92	*8.00*	27.95	*25 00*	7.98	*9.00*	7.30	5.58
10.12	*8.00*	27.46	*25.00*	8.16	*9.00*	6.88	5.88
9.52	*8.00*	27.71	*25.00*	8.07	*9.00*	7.09	5.86
9.20	*10.00*	28.76	*27.00*	6.23	*8.00*	7.10	6.34
9.97	*10.00*	25.88	*27.00*	6.65	*8.00*	9.56	6.56
8.77	*10.00*	22.76	*27.00*	6.03	*8.00*	9.22	6.22
10.01	*10.00*	25.01	*27.00*	6.09	*8.00*	7.42	6.78
8.35	*10.00*	24.82	*27.00*	5.98	*8.00*	8.98	6.06
9.76	*10.00*	21.83	*27.00*	4.64	*8.00*	9.07	6.02
9.34	*10.00*	24.84	*27.00*	5.94	*8.00*	8.56	6.33
8.23	*10.00*	25.29	*27.00*	7.83	*8.00*	9.58	7.07
9.35	*10.00*	25.93	*27.00*	7.92	*8.00*	8.74	7.00
9.32	*10.00*	21.90	*27.00*	9.71	*8.00*	9.95	6.69
9.03	*10.00*	23.35	*27.00*	8.76	*8.00*	8.12	7.36
9.58	*10.00*	23.31	*27.00*	9.02	*8.00*	9.80	6.95
8.66	*10.00*	24.98	*27.00*	8.22	*8.00*	7.57	7.19
8.63	*10.00*	23.94	*27.00*	11.73	*8.00*	9.48	6.41
8.17	*10.00*	24.44	*27.00*	8.38	*8.00*	9.48	6.97
8.87	*10.00*	24.13	*27.00*	8.95	*8.00*	9.09	6.96

PRIME COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Arkansas Valley Cotton Oil Co., **Dardanelle, Ark.** Cotton Seed Meal Feed.	3	3032	39.97	*38.00*
Bastrop Cotton Oil Co., **Bastrop, La.** Cotton Seed Meal Feed.	2	1204	41.50	*40.00*
	1	1749	38.75	*40.00*
Average	3		40.13	*40.00*
Breaux Bridge Cotton Oil Co., **Breaux Bridge, La.** Cotton Seed Meal.	1	2094	39.69	*40.90*
Brookhaven Cotton Oil Co., **Brookhaven, Miss.** Cotton Seed Meal.	1	1026	42.75	*38.00*
	1	1194	39.31	*38.00*
	2	2144	40.94	*38.00*
	2	757	38.08	*38.00*
Average	6		40.27	*38.00*
Buckeye Cotton Oil Co., **Jackson, Miss.** Cotton Seed Meal.	1	1536	39.87	*40.25*
Centerville Cotton Oil Co., **Centerville, Miss.** Cotton Seed Meal.	2	645	41.69	*40.00*
	1	814	40.38	*40.00*
Average	3		41.04	*40.00*
Central Cotton Oil Co., **Deeson, Miss.** Cotton Seed Meal.	4	935	39.63	*38.75*
Columbia Cotton Oil Mill & Mfg. Co., **New Orleans, La.** Cotton Seed Meal.	1	678	41.53	*37.87*
	3	724	38.06	*37.87*
	2	1021	41.50	*37.87*
	3	1384	36.31	*37.87*
	2	1826	39.56	*37.87*
	2	2030	39.63	*37.87*
	1	2131	38.69	*37.87*
Average	14		39.33	*37.87*

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*The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar- anteed	% Found	% Guar- anteed	% Found	% Guar- anteed	% Found	% Found
9.87	*8.00*	23.10	*25.00*	10.32	*9.00*	9.41	7.33
9.71	*7.50*	21.68	*15.00*	10.75	*10.00*	9.14	7.22
11.85	*7.50*	23.17	*15.00*	11.30	*10.00*	8.10	6.83
10.78	*7.50*	22.43	*15.00*	11.02	*10.00*	8.62	7.02
9.13	....	25.30	....	10.12	....	9.71	6.05
8.77	*7.00*	24.30	*32.00*	10.55	*12.00*	7.59	6.04
7.82	*7.00*	26.42	*32.00*	11.70	*12.00*	8.58	6.17
7.63	*7.00*	23.11	*32.00*	13.40	*12.00*	9.17	5.75
7.36	*7.00*	27.37	*32.00*	13.14	*12.00*	8.30	5.75
7.90	*7.00*	25.30	*32.00*	12.20	*12.00*	8.41	5.92
9.06	*9.55*	22.49	*23.55*	12.03	*11.95*	10.36	6.19
11.87	*8.00*	24.14	*26.00*	6.16	*3.00*	8.90	7.24
8.82	*8.00*	28.85	*26.00*	6.22	*3.00*	9.27	6.46
10.35	*8.00*	26.49	*26.00*	6.19	*3.00*	9.08	6.85
9.66	*7.75*	25.41	*25.00*	9.90	*8.40*	8.10	7.30
9.42	*10.70*	23.43	*26.57*	8.96	*8.87*	9.43	7.23
9.60	*10.70*	27.12	*26.57*	10.52	*8.87*	7.94	6.76
11.00	*10.70*	23.12	*26.57*	9.10	*8.87*	8.14	7.14
10.90	*10.70*	25.36	*26.57*	10.61	*8.87*	9.34	7.48
9.18	*10.70*	24.82	*26.57*	11.25	*8.87*	7.94	7.25
9.19	*10.70*	23.64	*26.57*	10.64	*8.87*	10.12	6.78
9.75	*10.70*	26.20	*26.57*	10.97	*8.87*	8.47	5.92
9.86	*10.70*	24.81	*26.57*	10.29	*8.87*	8.77	6.94

PRIME COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Concordia Cotton Oil Co.,	2	807	36.44	*40.00*
Vidalia, La.	3	976	38.06	*40.00*
Cotton Seed Meal.	2	1419	41.13	*40.00*
	4	1514	39.56	*40.00*
	2	1656	40.44	*40.00*
	3	1905	41.19	*40.00*
Average	16		39.47	*40.00*
E. L. Erwin,	1	1610	38.56	*38.00*
Clinton, La.	2	1068	42.25	*38.00*
Cotton Seed Meal.				
Average	3		40.41	*38.00*
Eastman Oil Mills, **Jonestown, Miss.** Cotton Seed Meal.	5	1622	39.44	*38.75*
Feliciana Oil Co.,	2	760	36.25	*40.00*
St. Francisville, La.	1	1074	42.56	*40.00*
Cotton Seed Meal.	3	1383	43.19	*40.00*
	1	1617	40.31	*40.00*
Average	7		40.58	*40.00*
Indianola Cotton Oil Co., **Indianola, Miss.** Cotton Seed Meal.	3	772	38.56	*38.75*
Jackson Cotton Oil Co.,	1	900	39.75	*41.00*
Jackson, Miss.	1	1477	41.63	*41.00*
Cotton Seed Meal.	2	764	41.56	*41.00*
Average	4		40.99	*41.00*
Madison Cotton Oil Co.,	1	853	44.44	*40.00*
Tallulah, La.	2	1547	36.00	*40.00*
Cotton Seal Meal Feed.	2	990	37.63	*40.00*
Average	5		39.35	*40.00*

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* The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed.	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
17.00	*6.00*	23.49	*27.00*	7.77	*8.00*	8.47	6.83
11.70	*6.00*	23.21	*27.00*	12.29	*8.00*	8.18	6.61
9.69	*6.00*	22.01	*27.00*	9.87	*8.00*	10.08	7.22
11.66	*6.00*	24.46	*27.00*	7.87	*8.00*	9.29	7.16
12.46	*6.00*	24.24	*27.00*	8.04	*8.00*	7.57	7.25
10.92	*6.00*	21.65	*27.00*	9.55	*8.00*	9.60	7.09
12.24	*6.00*	23.18	*27.00*	9.22	*8.00*	8.86	7.03
9.34	*10.00*	25.46	*21.00*	11.62	*9.00*	8.71	6.31
9.99	*10.00*	23.08	*21.00*	9.74	*9.00*	8.84	6.10
9.67	*10.00*	24.27	*21.00*	10.68	*9.00*	8.77	6.20
11.34	*8.20*	24.42	*25.00*	8.81	*9.50*	8.45	7.54
11.53	*8.00*	29.48	*26.00*	7.86	*3.00*	9.06	5.82
11.69	*8.00*	23.05	*26.00*	7.60	*3.00*	8.49	6.61
9.28	*8.00*	23.85	*26.00*	8.77	*3.00*	8.46	6.45
9.78	*8.00*	25.01	*26.00*	10.44	*3.00*	8.20	6.26
10.57	*8.00*	25.35	*26.00*	8.67	*3.00*	8.55	6.28
11.10	*8.20*	17.47	*25.00*	7.58	*9.50*	10.69	7.01
8.47	*10.00*	22.75	*27.00*	13.60	*8.00*	9.12	6.31
8.10	*10.00*	24.10	*27.00*	10.69	*8.00*	9.17	6.31
8.66	*10.00*	25.93	*27.00*	9.68	*8.00*	8.05	6.12
8.40	*10.00*	24.26	*27.00*	11.32	*8.00*	8.78	6.25
8.37	*8.00*	25.20	*26.00*	6.12	*8.00*	9.09	6.78
9.80	*8.00*	24.88	*26.00*	12.64	*8.00*	9.93	6.75
10.23	*8.00*	20.09	*26.00*	12.85	*8.00*	12.24	6.96
9.47	*8.00*	23.39	*26.00*	10.54	*8.00*	10.42	6.83

PRIME COTTON

Name of Manufacturer or Jobber and Brand.	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Mississippi Cotton Oil Co., **Jackson, Miss.** Cotton Seed Meal.	2	653	40.28	38.63
	2	716	37.38	38.63
	3	908	40.56	38.63
	1	1221	42.75	38.63
	1	1696	38.59	38.63
Average	9		39.91	38.63
Mixten City Oil Works, **Mixten City, Miss.** Cotton Seed Meal.	3	1155	38.69	38.75
Perkins Oil Co., **Memphis, Tenn.** Cotton Seed Meal Feed.	1	1478	39.19	38.00
Piedmont Oil Refg. Co., **Farmerdale, Ala.** Cotton Seed Meal Feed, 2nd Grade.	1	1969	40.50	38.00
	1	2071	40.25	38.00
Average	2		40.38	38.00
Planters' Oil Mill, **Monroe, La.** Cotton Seed Meal.	2	763	36.01	42.00
	1	664	41.16	42.00
	3	1020	38.50	42.00
	2	1548	40.06	42.00
	1	1858	40.44	42.00
Average	9		39.23	42.00
Port Gibson Oil Works, **Port Gibson, Miss.** Cotton Seed Meal.	6	703	37.75	38.00
	1	1475	39.50	38.00
	2	1024	39.87	38.00
	3	1310	40.63	38.00
	1	847	41.38	38.00
	1	1954	38.38	38.00
Average	14		39.58	38.00
Raccourci Cotton Oil Co., **Batchelor, La.** Cotton Seed Meal.	1	905	40.13	40.00

*The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
7.19	*10.00*	25.47	*27.37*	10.08	*9.00*	9.55	7.43
9.54	*10.00*	28.18	*27.37*	11.29	*9.00*	7.89	5.72
10.25	*10.00*	22.92	*27.37*	11.03	*9.00*	9.05	6.19
10.00	*10.00*	22.06	*27.37*	10.77	*9.00*	7.83	6.59
12.41	*10.00*	23.45	*27.37*	10.66	*9.00*	8.81	6.08
9.88	*10.00*	24.42	*27.37*	10.77	*9.00*	8.62	6.40
8.44	*8.20*	25.41	*25.00*	10.99	*9.50*	9.30	7.17
8.91	*8.00*	26.36	*25.00*	9.17	*9.00*	9.25	7.12
10.48	*8.00*	24.09	*25.00*	9.58	*18.00*	9.00	6.35
11.94	*8.00*	22.67	*25.00*	8.89	*18.00*	9.96	6.29
11.21	*8.00*	23.38	*25.00*	9.23	*18.00*	9.48	6.32
12.60	*8.00*	26.80	*15.00*	10.54	*10.00*	7.74	6.31
9.07	*8.00*	24.86	*15.00*	9.66	*10.00*	7.66	7.59
11.45	*8.00*	23.15	*15.00*	13.19	*10.00*	8.00	6.71
9.02	*8.00*	23.33	*15.00*	11.67	*10.00*	9.77	6.15
9.65	*8.00*	22.75	*15.00*	11.32	*10.00*	8.63	7.01
10.16	*8.00*	24.18	*15.00*	11.28	*10.00*	8.40	6.75
8.34	*8.00*	28.84	*32.00*	9.92	*11.00*	9.08	6.07
8.22	*8.00*	25.18	*32.00*	10.97	*11.00*	9.33	6.80
9.07	*8.00*	24.60	*32.00*	13.11	*11.00*	7.23	6.12
9.61	*8.00*	22.50	*32.00*	12.67	*11.00*	8.01	6.58
9.01	*8.00*	26.91	*32.00*	7.73	*11.00*	8.82	6.15
9.60	*8.00*	24.46	*32.00*	13.10	*11.00*	8.70	5.76
8.98	*8.00*	25.42	*32.00*	11.25	*11.00*	8.52	6.25
11.81	*7.00*	22.26	*26.00*	9.52	*8.00*	8.90	7.38

PRIME COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Red River Cotton Oil Co.,	1	1609	38.31	*30.00*
Alexandria, La.	1	845	38.63	*30.00*
Cotton Seed Meal.	8	930	38.69	*30.00*
	6	1042	41.10	*30.00*
	3	1350	39.44	*30.00*
Average	19		39.23	*30.00*
Cotton Seed Meal.	1	846	40.44	*38.75*
Sonia Cotton Oil Co.,	2	826	38.44	*42.00*
Alexandria, La.	7	1002	42.63	*42.00*
Cotton Seed Meal.	4	1121	41.69	*42.00*
	1	2158	40.38	*42.00*
	14		40.78	*42.00*
Tensas Cotton Oil & Mfg. Co.,	1	679	40.19	*40.00*
St. Joseph, La.	1	829	41.44	*40.00*
Cotton Seed Meal Feed.	1	1615	37.16	*40.00*
	3		39.60	*40.00*
The Union Oil Co.,	5	945	39.75	*33.00*
Bunkie, La.	3	1125	39.38	*33.00*
Bunkie Mill Cotton Seed Meal Feed.	1	1855	36.84	*33.00*
Average	9		38.66	*33.00*
The Union Oil Co.,	7	709	41.75	*41.00*
Monroe, La.	3	890	39.88	*41.00*
Cotton Seed Meal.	3	1119	40.13	*41.00*
	1	1490	41.44	*41.00*
Average	14		40.81	*41.00*
The Union Oil Co.,	1	904	42.06	*41.00*
Torras, La.	1	1390	41.06	*41.00*
Cotton Seed Meal.	1	1712	39.11	*41.00*
	1	1977	39.81	*41.00*
Average	4		40.51	*41.00*
The Union Oil Co.,	2	811	36.81	*41.00*
Vidalia, La.	1	1389	41.81	*41.00*
Cotton Seed Meal.	1	1865	40.19	*41.00*
Average	4		39.60	*41.00*

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* The color and odor are not considered in grading these samples.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
8.27 9.99 9.83 8.36 8.83	*7.25* *7.25* *7.25* *7.25* *7.25*	27.11 26.24 24.56 25.52 24.86	*35.00* *35.00* *35.00* *35.00* *35.00*	10.70 9.73 10.67 10.66 10.69	*25.00* *25.00* *25.00* *25.00* *25.00*	8.94 9.07 9.57 7.19 8.89	6.67 6.34 6.69 7.22 7.29
9.06	*7.25*	25.66	*35.00*	10.49	*25.00*	8.72	6.84
8.64	*8.20*	27.05	*25.00*	6.62	*9.50*	9.80	7.45
8.29 9.19 8.49 8.36	*7.00* *7.00* *7.00* *7.00*	28.00 23.45 24.15 24.95	*18.00* *18.00* *18.00* *18.00*	9.26 8.79 8.98 10.10	*9.00* *9.00* *9.00* *9.00*	8.98 8.72 9.58 9.30	7.03 7.22 7.11 6.91
8.58	*7.00*	25.14	*18.00*	9.28	*9.00*	9.15	7.07
10.62 9.85 8.63	*8.00* *8.00* *8.00*	22.85 24.22 25.56	*26.00* *26.00* *26.00*	9.34 6.46 13.06	*8.00* *8.00* *8.00*	9.10 10.36 8.87	7.90 7.67 6.72
9.70	*8.00*	24.21	*26.00*	9.62	*8.00*	9.44	7.43
12.05 10.13 9.20	*9.00* *9.00* *9.00*	23.77 25.82 26.27	*27.00* *27.00* *27.00*	8.53 8.77 11.80	*11.00* *11.00* *11.00*	9.04 8.84 9.30	6.86 7.06 6.59
10.46	*9.00*	25.29	*27.00*	9.70	*11.00*	9.06	6.83
10.28 8.90 10.55 8.91	*10.00* *10.00* *10.00* *10.00*	24.98 24.24 22.31 22.26	*27.00* *27.00* *27.00* *27.00*	7.63 10.31 10.62 11.52	*8.00* *8.00* *8.00* *8.00*	8.58 9.75 9.57 9.30	6.78 6.92 6.82 6.57
9.66	*10.00*	23.45	*27.00*	10.02	*8.00*	9.30	6.77
9.27 7.24 8.13 8.08	*10.00* *10.00* *10.00* *10.00*	23.55 25.08 24.93 22.76	*27.00* *27.00* *27.00* *27.00*	8.79 9.83 12.47 13.23	*8.00* *8.00* *8.00* *8.00*	9.06 9.68 8.56 9.65	7.28 7.11 6.80 6.47
8.18	*10.00*	24.08	*27.00*	11.08	*8.00*	9.24	6.91
11.73 9.77 10.00	*10.00* *10.00* *10.00*	25.46 20.98 22.25	*27.00* *27.00* *27.00*	10.57 10.13 11.47	*8.00* *8.00* *8.00*	8.70 10.22 8.95	6.73 7.09 7.14
10.50	*10.00*	22.90	*27.00*	10.72	*8.00*	9.29	6.99

GOOD COTTON

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Capital City Oil Mill,	2	766	36.11	*40.00*
Baton Rouge, La.	2	897	39.25	*40.00*
Cotton Seed Meal Feed.	2	1644	37.56	*40.00*
Average	6		37.64	*40.00*
Cotton Seed Meal.	1	1864	36.75	*34.50*
Colfax Cotton Oil Co., **Colfax, La.** Cotton Seed Meal.	2	970	36.81	*40.00*
De Soto Oil Co., **Memphis, Tenn.** Cotton Seed Meal Feed.	2	1668	37.88	*38.00*
Longbridge Cotton Oil Co., **Longbridge, La.** Cotton Seed Meal Feed.	7	1766	37.50	*33.00*
New Roads Oil Mill & Mfg. Co.,	2	823	37.34	*37.62*
New Roads, La.	1	1207	37.37	*37.62*
Cotton Seed Meal Feed.	1	1745	35.56	*37.62*
Average	4		36.76	*37.62*
Phoenix Cotton Oil Co., **Memphis, Tenn.**	1	2070	36.75	*38.00*
Summit Gin Improvement Co., **Summit, Miss.** Cotton Seed Meal Feed.	1	1842	38.31	*38.75*
Washington Cotton and Oil Co.,	3	946	37.43	*35.00*
Washington, La.	3	1129	39.00	*35.00*
Washington Brand Cotton Seed Meal.				
Average	6		38.22	*35.00*
J. Lindsay Wells,	1	1387	33.28	*41.00*
Memphis, Tenn.	3	1804	36.50	*41.00*
Cotton Seed Meal "Star."	3	1927	37.37	*41.00*
	1	2054	41.13	*41.00*
Average	8		37.07	*41.00*
The Union Oil Co., **Gretna, La.** Cotton Seed Meal.	1	656	38.25	*41.00*

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*The color and odor are not considered in grading these meals.

SEED MEAL.*

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Found
6.13	*7.00*	38.80	*26.00*	12.08	*8.00*	8.75	6.13
6.85	*7.00*	25.82	*26.00*	12.73	*8.00*	9.19	6.16
7.37	*7.00*	26.77	*26.00*	15.33	*8.00*	6.69	6.28
6.78	*7.00*	27.80	*26.00*	13.38	*8.00*	8.21	6.19
7.33	*6.50*	25.27	*28.00*	15.05	*12.00*	9.23	6.37
12.88	*8.00*	24.05	*26.00*	11.11	*8.00*	8.56	6.59
9.64	*8.00*	25.56	*25.00*	11.55	*9.00*	8.17	7.15
8.12	*9.00*	26.91	*27.00*	12.26	*11.00*	8.43	6.78
12.37	*12.50*	25.31	*25.99*	9.24	*9.00*	8.98	6.76
12.70	*12.50*	23.59	*25.99*	11.48	*9.00*	8.09	6.77
9.01	*12.50*	27.43	*25.99*	14.12	*9 00*	7.30	6.58
11.36	*12.50*	25.45	*25.99*	11.61	*9.00*	8.12	6.70
11.85	*8.00*	25.33	*25.00*	10.64	*9.00*	9.59	5.84
11.35	*8.20*	25.67	*25.00*	8.77	*9.50*	8.22	7.68
13.35	*8.00*	24.21	*25.00*	11.06	*12.00*	8.25	5.70
8.62	*8.00*	26.39	*25.00*	11.47	*12.00*	8.56	5.96
10.99	*8.00*	25.30	*25.00*	11.26	*12.00*	8.40	5.83
7.95	*9.00*	28.23	*25.00*	15.26	*7.00*	9.24	6.04
10.93	*9.00*	25.21	*25.00*	12.06	*7.00*	8.35	6.95
11.35	*9.00*	22.00	*25.00*	13.05	*7.00*	9.35	6.88
10.28	*9.00*	22.92	*25.00*	8.56	*7.00*	9.67	7.44
10.13	*9.00*	24.59	*25.00*	12.23	*7.00*	9.15	6.83
7.48	*10.00*	26.35	*27.00*	12.87	*8.00*	8.45	6.61

OFF COTTON

Name of Manufacturer or Jobber and Brand.	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Boyce Cotton Oil & Mfg. Co., **Boyce, La.** Cotton Seed Meal.	1	1209	34.44	40.00
Caddo Cotton Oil Co., **Shreveport, La.** Cotton Seed Meal.	1	1040	26.13	
	1	1041	25.88	
Average	2		26.00	
Greensboro Cotton Oil Co., **Greensboro, Ala.** Cotton Seed Meal.	3	869	35.84	38.75
	1	1211	40.69	38.75
Average	4		38.22	38.75
Lake End Oil Mill, **Lake End, La.** Cotton Seed Meal.	1	1386	35.38	40.00
Lake Providence Cotton Oil Co., **Lake Providence, La.** Cotton Seed Meal.	1	1744	35.00	40.00
	1	1388	35.81	40.00
Average	2		35.40	40.00
Planters' Oil Mill, **Tunica, Miss.** Cotton Seed Meal Feed.	2	1197	34.75	38.75
Phoenix Oil Co., **Walnut Ridge, Ark.**	1	1588	35.06	38.75
Southern Cotton Oil Co., **Memphis, Tenn.**	2	819	19.56	23.00
	2	987	22.31	23.00
Average	4		20.93	23.00
Tennessee Fiber Co., **Memphis, Tenn.** Creamo Brand Cotton Seed Meal.	1	1081	20.63	22.00
	5	1167	24.00	22.00
	4	734	23.31	22.00
	1	666	19.03	22.00
	2	1677	21.81	22.00
	1	2134	18.44	22.00
Average	14		21.20	22.00
J. Lindsay Wells Co., **Memphis, Tenn.** Sunny South.	2	1192	25.75	24.00
	1	1964	21.97	24.00
	1	2166	20.94	24.00
Average	4		22.89	24.00

SEED MEAL.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed.	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
16.60	*8.00*	23.19	*26.00*	11.74	*8.00*	7.89	6.14
7.68		28.11		23.52		7.92	5.64
6.93		30.36		23.80		7.60	5.43
7.31		29.74		23.66		7.76	5.53
9.67	*8.20*	28.33	*25.00*	9.02	*9.50*	10.42	6.72
11.40	*8.20*	24.35	*25.00*	8.89	*9.50*	8.00	6.67
10.54	*8.20*	26.34	*25.00*	8.95	*9.50*	9.21	6.69
16.78	*8.00*	22.82	*26.00*	9.78	*8.00*	8.43	6.81
14.31	*8.00*	25.15	*26.00*	11.10	*8.00*	8.06	6.38
11.63	*8.00*	24.25	*26.00*	11.77	*8.00*	9.72	6.82
12.97	*8.00*	24.70	*26.00*	11.44	*8.00*	8.89	6.60
10.20	*8.20*	27.71	*25.00*	11.43	*9.50*	8.69	7.22
6.84	*8.20*	30.40	*25.00*	13.23	*9.50*	7.75	6.72
4.78	*4.00*	38.22	*35.00*	21.53	*20.00*	11.11	4.80
5.47	*4.00*	34.04	*35.00*	23.36	*20.00*	10.08	4.74
5.13	*4.00*	36.13	*35.00*	22.45	*20.00*	10.59	4.77
4.97	*5.00*	36.36	*38.00*	23.10	*28.00*	10.35	4.59
5 63	*5.00*	32.96	*38.00*	21.64	*28.00*	10.60	5.17
5.82	*5.00*	34.84	*38.00*	21.95	*28.00*	9.10	4.98
5.08	*5.00*	37.83	*38.00*	24.25	*28.00*	8.76	5.05
4.79	*5.00*	35.65	*38.00*	23.55	*28.00*	9.49	4.71
5.22	*5.00*	37.05	*38.00*	25.39	*28.00*	9.54	4.36
5.26	*5 00*	35.78	*38.00*	23.31	*28.00*	9.64	4.81
5.99	*5.00*	34.05	*32.00*	19.03	*22.00*	9.81	5.37
4.55	*5.00*	35.55	*32.00*	23.25	*22.00*	10.40	4.28
5 36	*5.00*	35.01	*32.00*	23.77	*22.00*	10.29	4.63
5.30	*5.00*	34.87	*32.00*	22.02	*22.00*	10.16	4.76

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Abbeville Rice Milling Co.,	1	835	12.13	*10.00*
Abbeville, La.	2	957	11.63	*10.00*
Rice Bran.	1	1369	11.38	*10.00*
Average	4		11.71	*10.00*
American Rice Mill,	2	771	5.94	*7.50*
Crowley, La.	4	942	7.44	*7.50*
Rice Bran.	1	1404	6.94	*7.50*
Average	7		6.79	*7.50*
Conover Rice M. Co., Ltd.,	2	753	11.88	*9.00*
Mermentau, La.	1	1043	11.06	*9.00*
Rice Bran.	8	1145	12.00	*9.00*
	2	1280	12.43	*9.00*
	2	1464	11.19	*9.00*
	1	1715	11.81	*9.00*
Average	16		11.73	*9.00*
Crowley Rice Milling Co.,	1	820	12.13	*13.12*
Crowley, La.	4	1228	12.06	*13.12*
Rice Bran.				
Average	5		12.10	*13.12*
Rice Bran.	1	675	12.03	*13.94*
Donaldsonville Rice Mill,	1	879	10.44	*13.81*
Donaldsonville, La.	2	1086	9.56	*13.81*
Rice Bran.	1	1410	10.31	*13.81*
Average	4		10.10	*13.81*
Rice Bran.	1	1084	10.56	*13.88*
Egan Rice Mill Co., Ltd., **Egan, La.** Rice Bran.	2	975	12.37	*11.06*
Empire Rice Mill Co.,	3	739	12.25	*11.39*
New Orleans, La.	3	884	11.31	*11.39*
Rice Bran.	8	1032	12.25	*11.39*
	6	1229	13.69	*11.39*
	1	1758	12.15	*11.39*
	1	1974	13.38	*11.39*
	1	2042	12.25	*11.39*
Average	23		12.47	*11.39*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash	Hulls
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found	% Found
10.35	*10.00*	51.08	*35.00*	8.22	*15.00*	9.65	8.57	
10.52	*10.00*	45.93	*35.00*	10.01	*15.00*	11.22	10.69	
8.68	*10.00*	52.51	*35.00*	9.53	*15.00*	9.07	8.83	
9.85	*10.00*	49.85	*35.00*	9.25	*15.00*	9.98	9.36	None
4.17	*5.32*	39.78	*40.00*	25.19	*25.00*	10.39	14.53	
4.57	*5.32*	38.56	*40.00*	25.76	*25.00*	8.93	14.74	
3.55	*5.32*	41.09	*40.00*	24.83	*25.00*	8.65	14.94	
4.09	*5.32*	39.81	*40.00*	25.26	*25.00*	9.32	14.73	50.82
9.83	*8.00*	51.56	*50.00*	9.68	*18.00*	10.31	6.74	
11.53	*8.00*	42.43	*50.00*	15.95	*18.00*	9.27	9.76	
10.27	*8.00*	48.56	*50.00*	11.56	*18.00*	9.14	8.47	
12.16	*8.00*	47.69	*50.00*	11.78	*18.00*	7.26	8.68	
9.54	*8.00*	52.36	*50.00*	9.97	*18.00*	9.73	7.21	
7.61	*8.00*	49.29	*50.00*	13.03	*18.00*	8.71	9.55	
10.16	*8.00*	48.65	*50.00*	11.99	*18.00*	9.07	8.40	6.63
9.50	*10.00*	38.17	*40.13*	18.00	*14.75*	9.55	12.65	
10.37	*10.00*	47.23	*40.13*	12.33	*14.75*	8.83	9.18	
9.94	*10.00*	42.70	*40.13*	15.16	*14.75*	9.19	10.91	17.18
10 32	*19.30*	37.32	*35.26*	17.55	*12.20*	9.37	13.41	25.14
9.10	*10.49*	44.91	*38.05*	15.55	*15.12*	9.75	10.25	
7.78	*10.49*	43.06	*38.05*	18.96	*15.12*	8.75	11.89	
9.52	*10.49*	42.49	*38.05*	16.34	*15.12*	10.31	11.03	
8.80	*10.49*	43.49	*38.05*	16.95	*15.12*	9.60	11.06	17.05
9.43	*4.20*	41.80	*62.75*	18.58	*4.73*	8.10	11.53	28.57
10.93	*10.87*	52.37	*48.64*	7.94	*12.87*	9.84	6.55	None
9.47	*10.50*	49.52	*44.80*	10.53	*12.50*	9.39	8.84	
10.33	*10.50*	50.07	*44.80*	10.62	*12.50*	9.30	8.37	
10.15	*10.50*	44.43	*44.80*	12.93	*12.50*	9.24	11.00	
12.74	*10.50*	43.38	*44.80*	12.39	*12 50*	9.03	8.77	
10.58	*10.50*	47.29	*44.80*	12.34	*12.50*	8.14	9.50	
9.98	*10.50*	44.94	*44.80*	12.35	*12.50*	9.40	9.95	
12.89	*10.50*	42.58	*44.80*	11.80	*12.50*	9.59	10.89	
10.88	*10.50*	46.03	*44.80*	11.85	*12.50*	9.16	9.61	6.16

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
The Eureka Rice Mill, **Estherwood, La.** Rice Bran.	1	810	13.19	*10.50*
	3	951	12.00	*10.50*
	1	1368	12.13	*10.50*
Average	5		12.44	*10.50*
Gulf Rice Milling Co., **Welsh, La.** Rice Bran.	1	834	11.56	*9.10*
	4	932	10.50	*9.10*
	2	1217	12.06	*9.10*
	1	1534	11.00	*9.10*
	1	1759	12.00	*9.10*
Average	9		11.42	*9.10*
Gueydan Rice Milling Co., **Gueydan, La.** Rice Bran.	1	1596	14.16	*11.94*
Haspel & Davis, **New Orleans, La.** Rice Bran.	1	665	10.31	*10.06*
	2	726	11.19	*10.06*
	2	883	10.69	*10.06*
	1	1044	11.44	*10.06*
	2	1403	11.38	*10.06*
	1	1726	11.18	*10.06*
	1	2162	11.56	*10.06*
Average	10		11.11	*10.06*
Hunter Rice Mill, **Crowley, La.** Rice Bran.	3	1264	9.00	*8.75*
	1	1658	10.38	*8.75*
Average	4		9.69	*8.75*
Ida Rice Mill, **Rayne, La.**	2	1023	11.38	*11.37*
Iota Rice Milling Co., **Iota, La.** Rice Bran.	1	1053	11.75	*10.00*
	2	1057	11.81	*10.00*
Average	3		11.78	*10.00*
Jennings Rice Milling Co., **Welsh, La.** Rice Bran.	2	770	9.25	*10.00*
	2	972	12.25	*10.00*
	3	1200	13.06	*10.00*
	2	1659	12.63	*10.00*
Average	8		11.80	*10.00*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash	Hulls
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found	% Found
11.45	*7.92*	45.04	*53.41*	11.30	*9.18*	9.94	9.08	
10.62	*7.92*	45.90	*53.41*	10.83	*9.18*	10.49	10.16	
9.96	*7.92*	47.52	*53.41*	11.88	*9.18*	9.03	9.48	
10.68	*7.92*	46.15	*53.41*	11.34	*9.18*	9.82	9.57	4.46
9.56	*8.50*	43.58	*40.00*	15.23	*21.00*	10.13	9.94	
8.44	*8.50*	45.72	*40.00*	15.10	*21.00*	9.37	10.87	
9.85	*8.50*	46.37	*40.00*	13.17	*21.00*	8.37	10.18	
8.88	*8.50*	46.29	*40.00*	13.27	*21.00*	10.25	10.31	
9.41	*8.50*	43.78	*40.00*	14.81	*21.00*	8.55	11.45	
9.23	*8.50*	45.15	*40.00*	14.32	*21.00*	9.33	10.55	14.39
12.75	*14.75*	45.86	*45.41*	9.91	*9.52*	7.99	9.33	None
9.45	*12.00*	42.10	*45.57*	16.68	*11.40*	8.99	12.53	
11.48	*12.00*	43.14	*45.57*	14.48	*11.40*	8.46	11.25	
10.77	*12.00*	41.69	*45.57*	15.78	*11.40*	10.35	10.72	
11.33	*12.00*	42.56	*45.57*	15.23	*11.40*	9.17	10.27	
9.84	*12.00*	44.47	*45.57*	15.22	*11.40*	9.35	9.74	
10.16	*12.00*	44.19	*45.57*	15.54	*11.40*	8.63	10.30	
11.92	*12.00*	41.87	*45.57*	13.94	*11.40*	9.38	11.33	
10.71	*12.00*	42.86	*45.57*	15.26	*11.40*	9.19	10.87	17.52
6.74	*9.50*	43.64	*40.42*	19.16	*20.75*	8.96	12.50	
5.83	*9.50*	44.68	*40.42*	16.60	*20.75*	7.99	14.52	
6.29	*9.50*	44.16	*40.42*	17.88	*20.75*	8.47	13.51	26.24
8.63	*9.80*	50.20	*44.05*	12.80	*14.25*	8.38	8.61	9.32
11.05	*11.00*	47.26	*42.00*	12.13	*15.00*	9.16	8.65	
11.64	*11.00*	46.48	*42.00*	12.56	*15.00*	8.40	9.11	
11.35	*11.00*	46.87	*42.00*	12.34	*15.00*	8.78	8.88	7.79
9.54	*10.00*	48.08	*39.00*	12.96	*18.00*	10.97	9.20	
11.87	*10.00*	44.76	*39.00*	12.46	*18.00*	9.42	9.24	
13.32	*10.00*	45.89	*39.00*	10.18	*18.00*	8.68	8.87	
9.12	*10.00*	46.97	*39.00*	13.09	*18.00*	8.03	10.16	
10.96	*10.00*	46.43	*39.00*	12.17	*18.00*	9.28	9.36	7.23

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Jennings Rice Milling Co.,	2	955	11.56	*10.00*
Jennings, La.	3	1226	11.44	*10.00*
Rice Bran.	2	1524	11.50	*10.00*
	1	1870	14.26	*10.00*
Average	8		12.19	*10.00*
Jones Bros.,	1	825	9.88	*10.00*
Crowley, La.	3	1450	10.31	*10.00*
Rice Bran.	1	1730	10.50	*10.00*
Average	5		10.23	*10.00*
Lake Arthur Rice Milling Co.,	1	837	12.38	*12.63*
Lake Arthur, La.	2	1302	13.19	*12.63*
Rice Bran.	1	1868	13.63	*12.63*
Average	4		13.07	*12.63*
Lake Charles Rice Milling Co., **Lake Charles, La.** Rice Bran.	2	1016	11.50	*8.00*
Lawrence & Hamilton,	4	933	9.69	*12.00*
New Orleans, La.	8	1237	9.63	*12.00*
Rice Bran.	1	1607	13.75	*12.00*
	3	1918	10.88	*12.00*
Average	16		10.98	*12.00*
Leona Rice Milling Co.,	3	1193	12.56	*11.44*
New Orleans, La.	4	1498	11.81	*11.44*
Rice Bran.	1	1725	12.15	*11.44*
	1	2092	12.69	*11.44*
	1	2164	12.37	*11.44*
Average	10		12.32	*11.44*
Levy's Rice Mill,	3	1227	9.87	*9.00*
New Orleans, La.	3	1614	8.58	*9.00*
Rice Bran.	1	2093	10.13	*9.00*
	2	2097	9.25	*9.00*
Average	9		9.46	*9.00*
Louisiana Irrigation Mill Co.,				
Crowley, La.	2	809	11.81	*8.00*
Rice Bran.	1	1407	10.69	*8.00*
Average	3		11.25	*8.00*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash	Hulls
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found	% Found
10.31	*10.00*	45.35	*39.00*	13.33	*18.00*	9.89	9.56	
9.74	*10.00*	44.89	*39.00*	14.38	*18.00*	9.03	10.52	
9.89	*10.00*	44.21	*39.00*	13.86	*18.00*	9.63	10.91	
13.12	*10.00*	47.72	*39.00*	9.15	*18.00*	8.70	7.05	
10.77	*10.00*	45.54	*39.00*	12.68	*18.00*	9.31	9.51	8.92
7.93	*12.00*	41.42	*42.00*	20.13	*15.00*	9.34	11.30	
8.36	*12.00*	45.91	*42.00*	14.12	*15.00*	10.73	10.57	
6.82	*12.00*	49.57	*42.00*	13.95	*15.00*	8.71	10.45	
7.71	*12.00*	45.63	*42.00*	16.07	*15.00*	9.59	10.77	20.21
10.33	*11.70*	49.65	*43.61*	9.94	*18.00*	10.31	7.39	
12.10	*11.70*	42.87	*43.61*	13.67	*18.00*	8.86	9.31	
11.57	*11.70*	44.08	*43.61*	13.70	*18.00*	7.63	9.39	
11.33	*11.70*	45.53	*43.61*	12.44	*18.00*	8.93	8.70	8.13
10.66	*8.00*	39.83	*35.00*	18.32	*25.00*	8.30	11.39	27.71
5.89	*8.00*	39.71	*45.00*	21.26	*15.00*	9.49	13.96	
6.24	*8.00*	41.88	*45.00*	19.79	*15.00*	8.92	13.54	
9.65	*8.00*	48.33	*45.00*	10.82	*15.00*	9.42	8.03	
6.83	*8.00*	40.74	*45.00*	19.58	*15.00*	9.35	12.62	
7.15	*8.00*	42.67	*45.00*	17.86	*15.00*	9.30	12.04	26.17
12.07	*8.87*	42.34	*53.55*	14.30	*9.37*	8.87	9.86	
10.05	*8.87*	51.01	*53.55*	10.61	*9.37*	8.86	7.66	
8.08	*8.87*	50.60	*53.55*	11.67	*9.37*	9.27	8.23	
12.53	*8.87*	44.35	*53.55*	11.21	*9.37*	9.17	10.05	
14.18	*8.87*	39.82	*53.55*	11.96	*9.37*	10.13	11.54	
11.38	*8.87*	45.63	*53.55*	11.95	*9.37*	9.25	9.47	6.49
7.30	*8.35*	42.34	*44.00*	19.31	*18.00*	8.20	12.98	
5.38	*8.35*	39.21	*44.00*	23.33	*18.00*	8.55	14.95	
7.02	*8.35*	43.17	*44.00*	19.68	*18.00*	8.71	11.29	
9.25	*8.35*	38.00	*44.00*	19.80	*18.00*	10.03	13.59	
7.24	*8.35*	40.68	*44.00*	20.55	*18.00*	8.87	13.20	35.13
8.70	*10.00*	48.83	*40.00*	11.13	*20.00*	10.88	8.65	
8.77	*10.00*	48.49	*40.00*	12.77	*20.00*	10.77	8.51	
8.74	*10.00*	48.66	*40.00*	1195.	*20.00*	10.82	8.58	6.49

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Louisiana Irrigation Mill Co., **Morse, La.** Rice Bran.	1	838	11.69	*8.00*
	1	1054	11 50	*8.00*
	1	1313	11.50	*8.00*
Average	3		11.56	*8.00*
Louisiana Irrigation Mill Co., **Jennings, La.** Rice Bran.	1	839	11.44	*8.00*
	3	1286	13.06	*8 00*
Average	4		12.25	*8.00*
Louisiana Irrigation Mill Co., **Roanoke, La.** Rice Bran.	1	1051	11.81	*8.00*
Morse Mill Co., Ltd., **Morse, La.** Rice Bran.	1	831	10.13	*9 62*
	1	1077	11.06	*9.62*
Average	2		10.60	*9.62*
Mutual Rice Mill, **Gueydan, La.** Rice Bran.	2	1058	14.00	*14.25*
	2	1409	13.81	*14.25*
Average	4		13.91	*14.25*
National Rice Milling Co., **Crowley, La.** Rice Bran.	1	854	16.25	*12.06*
	3	1131	13.25	*12.06*
	1	1533	11.81	*12.06*
Average	5		13.77	*12.06*
Rice Bran.	2	1090	12.13	*2.31*
National Rice Milling Co., **New Orleans, La.** Rice Bran.	1	2163	12.43	*11.25*
	7	1651	12.43	*11.25*
	2	1849	12.43	*11.25*
	2	1942	12.63	*11.25*
Average	12		12.48	*11.25*
Rice Bran.	5	1553	12.75	*12.13*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash	Hulls
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found	% Found
12.35	*10.00*	42.45	*40.00*	13.64	*20.00*	9.60	10.27	
10.49	*10.00*	46.19	*40.00*	12.63	*20.00*	9.70	9.49	
9.96	*10.00*	45.60	*40.00*	13.14	*20.00*	8.88	10.92	
10.93	*10.00*	44.74	*40.00*	13.14	*20.00*	9.39	10.24	10.46
9.53	*10.00*	48.20	*40.00*	12.24	*20.00*	10.30	8.29	
11.55	*10.00*	48.14	*40.00*	11.14	*20.00*	7.74	8.37	
10.54	*10.00*	48.17	*40.00*	11.69	*20.00*	9.02	8.33	5.63
8.91	*10.00*	48.92	*40.00*	11.92	*20.00*	9.22	9.22	6.39
9.31	*8.75*	47.11	*53.88*	13.28	*9.25*	9.18	10.99	
8.36	*8.75*	49.01	*53.88*	12.53	*9.25*	8.74	10.39	
8.84	*8.75*	48.06	*53.88*	12.90	*9.25*	8.96	10.64	9.66
15.89	*13.53*	41.78	*42.92*	10.44	*9.26*	9.10	8.79	
16.01	*13.53*	40.22	*42.92*	10.75	*9.26*	10.53	8.68	
15.95	*13.53*	41.00	*42.92*	10.59	*9.26*	9.81	8.74	1.96
14.04	*10.90*	46.88	*51.59*	6.14	*6.55*	10.25	6.44	
11.68	*10.90*	47.15	*51.59*	8.84	*6.55*	9.22	9.86	
7.92	*10.90*	52.95	*51.59*	8.10	*6.55*	10.32	8.90	
11.21	*10.90*	49.00	*51.59*	7.69	*6.55*	9.93	8.40	None
11.13	*0.92*	47.89	*31.77*	9.29	*36.85*	9.27	10.29	None
8.12	*12.95*	54.70	*42.58*	8.16	*10.07*	10.18	6.47	
9.81	*12.95*	51.44	*42.58*	10.33	*10.07*	7.98	8.01	
10.05	*12.95*	49.76	*42.58*	10.95	*10.07*	7.96	8.85	
10.75	*12.95*	44.56	*42.58*	12.60	*10.07*	10.13	9.33	
9.68	*12.95*	50.72	*42.58*	10.51	*10.07*	9.06	8.15	1.70
9.63	*13.17*	51.64	*46.96*	7.38	*8.40*	8.94	9.66	None

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guar-anteed
New Iberia Rice Mill,	1	832	14.00	*13.63*
New Iberia, La.	1	1962	14.06	*13.63*
Rice Bran.				
Average	2		14.03	*13.63*
Orleans Rice Mill Co.,				
New Orleans, La.	3	741	10.49	*10.50*
Pure Rice Bran.	2	874	9.81	*10.50*
	3	1116	11.50	*10.50*
	1	1529	10.19	*10.50*
	1	2041	10.75	*10.50*
	1	2161	11.38	*10.50*
Average	11		10.69	*10.50*
Mixed Rice Bran.	3	723	5.63	*5.46*
	4	934	6.00	*5.46*
	1	1371	5.88	*5.46*
Average	8		5.84	*5.46*
Peoples' Independent Rice Mill Co.,	2	755	12.63	*11.06*
Crowley, La.	2	998	13.00	*11.06*
Rice Bran.	3	1127	13.44	*11.06*
	2	1382	11.38	*11.06*
Average	9		12.61	*11.06*
Planters' Rice Mill Co., Ltd.,	2	1015	12.63	*10.00*
Abbeville, La.	1	1660	12.69	*10.00*
Rice Bran.				
Average	3		12.66	*10.00*
Rayne Rice Mill Co., Ltd.,	1	849	8.56	*7.00*
Rayne, La.	2	974	7.75	*7.00*
Rice Bran.	4	1244	7.19	*7.00*
	6	1422	7.13	*7.00*
	7	1559	7.75	*7.00*
	3	1813	7.56	*7.00*
	3	1917	7.25	*7.00*
	1	2082	7.63	*7.00*
	3	2129	7.25	*7.00*
Average	30		7.56	*7.00*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash	Hulls
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found	% Found
12.02	*16.87*	48.85	*43.46*	6.92	*6.62*	9.93	8.28	
6.80	*16.87*	54.75	*43.46*	6.65	*6.62*	10.23	7.51	
9.41	*16.87*	51.80	*43.46*	6.78	*6.62*	10.09	7.89	None
8.56	*8.75*	48.49	*52.00*	13.00	*13.25*	9.43	10.03	
9.54	*8.75*	43.12	*52.00*	16.59	*13.25*	8.90	12.04	
8.94	*8.75*	46.38	*52.00*	13.84	*13.25*	9.26	10.08	
7.71	*8.75*	48.56	*52.00*	11.06	*13.25*	10.10	12.38	
9.54	*8.75*	42.41	*52.00*	15.35	*13.25*	9.21	12.74	
11.19	*8.75*	44.78	*52.00*	11.47	*13.25*	10.33	10.85	
9.25	*8.75*	45.62	*52.00*	13.55	*13.25*	9.54	11.35	11.82
4.14	*3.23*	38.89	*36.61*	27.72	*28.87*	8.52	15.10	
3.39	*3.23*	33.79	*36.61*	30.66	*28.87*	8.17	17.99	
3.62	*3.23*	35.99	*36.61*	30.62	*28.87*	7.83	16.06	
3.72	*3.23*	36.23	*36.61*	29.66	*28.87*	8.17	16.38	65.37
13.24	*13.00*	46.42	*38.00*	9.62	*13.18*	9.49	8.60	
13.42	*13.00*	42.56	*38.00*	11.33	*13.18*	9.13	10.56	
13.11	*13.00*	44.70	*38.00*	10.22	*13.18*	9.43	9.10	
12.86	*13.00*	47.44	*38.00*	10.55	*13.18*	8.74	9.03	
13.16	*13.00*	45.28	*38.00*	10.43	*13.18*	9.20	9.32	1.43
10.42	*11.00*	50.43	*42.00*	9.10	*15.00*	9.56	7.86	
11.02	*11.00*	50.31	*42.00*	8.32	*15.00*	9.44	8.22	
10.72	*11.00*	50.37	*42.00*	8.71	*15.00*	9.50	8.04	None
3.92	*4.50*	40.10	*37.25*	23.75	*27.25*	9.31	14.36	
4.20	*4.50*	40.20	*37.25*	24.84	*27.25*	9.16	13.85	
3.77	*4.50*	42.39	*37.25*	23.55	*27.25*	9.05	14.05	
4.55	*4.50*	39.60	*37.25*	25.62	*27.25*	8.26	14.84	
3.57	*4.50*	42.09	*37.25*	24.46	*27.25*	8.20	13.93	
2.88	*4.50*	36.83	*37.25*	29.28	*27.25*	8.15	15.30	
3.33	*4.50*	38.48	*37.25*	26.93	*27.25*	8.20	15.81	
3.11	*4.50*	41.60	*37.25*	25.02	*27.25*	8.22	14.42	
2.69	*4.50*	40.95	*37.25*	25.50	*27.25*	8.44	15.17	
3.58	*4.50*	40.24	*37.25*	25.44	*27.25*	8.55	14.63	51.42

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed.
Sieverd Milling Co., **New Orleans, La.** Rice Bran.	3	736	11.13	*10.50*
	1	2160	10.06	*10.50*
Average	4		10.60	*10.50*
Rice Bran.	1	672	10.47	*11.30*
Southern Rice Milling Co., **New Orleans, La.** Rice Bran.	2	973	10.31	*10.50*
	9	691	7.56	*10.50*
	3	1199	9.31	*10.50*
	3	1365	9.25	*10.50*
Average	17		9.11	*10.50*
Rice Bran.	2	652	9.97	*10.50*
A. Socola, **New Orleans, La.** A. S. Rice Bran.	3	650	11.16	*11.37*
	10	694	12.06	*11.37*
	4	872	10.38	*11.37*
	1	1048	10.94	*11.37*
	5	1296	12.00	*11.37*
	4	1453	10.94	*11.37*
	1	1716	12.37	*11.37*
	1	1948	10.88	*11.37*
	5	2106	12.19	*11.37*
	1	2040	12.94	*11.37*
Average	38		11.59	*11.37*
M. Rice Bran.	5	704	7.00	*6.06*
	1	1049	7.13	*6.06*
	2	1552	8.69	*6.06*
Average	8		7.61	*6.06*
United States Rice Milling Co., **Crowley, La.** Rice Bran.	2	996	11.00	*9.69*
	3	1190	12.25	*9.69*
	2	1463	12.63	*9.69*
	1	1714	14.00	*9.69*
	1	2132	11.38	*9.69*
Average	9		12.25	*9.69*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash	Hulls
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found	% Found
10.52	*10.75*	42.70	*44.00*	15.65	*14.00*	9.44	10.56	
10.07	*10.75*	41.31	*44.00*	16.74	*14.00*	9.44	12.38	
10.30	*10.75*	42.00	*44.00*	16.19	*14.00*	9.44	11.47	20.61
10.98	*12.26*	40.44	*43.64*	15.90	*12.82*	9.53	12.68	19.65
8.88	*9.50*	46.71	*44.75*	11.77	*15.75*	9.28	13.05	
7.30	*9.50*	40.87	*44.75*	21.52	*15.75*	8.12	14.63	
6.74	*9.50*	45.15	*44.75*	18.33	*15.75*	9.08	11.39	
6.96	*9.50*	42.26	*44.75*	20.08	*15.75*	8.63	12.82	
7.47	*9.50*	43.74	*44.75*	17.93	*15.75*	8.78	12.97	26.41
10.61	*9.50*	42.10	*39.39*	15.63	*18.68*	9.56	12.13	18.75
12.38	*12.50*	43.66	*42.27*	12.63	*14.40*	8.12	12.05	
12.01	*12.50*	43.37	*42.27*	13.10	*14.40*	8.13	11.33	
9.89	*12.50*	43.40	*42.27*	13.82	*14.40*	10.32	12.19	
8.63	*12.50*	43.43	*42.27*	16.75	*14.40*	8.71	11.54	
9.96	*12.50*	47.35	*42.27*	12.30	*14.40*	7.77	10.62	
9.52	*12.50*	43.48	*42.27*	14.94	*14.40*	10.66	10.46	
10.44	*12.50*	44.96	*42.27*	13.30	*14.40*	8.90	10.03	
7.83	*12.50*	44.59	*42.27*	16.53	*14.40*	9.25	10.92	
12.29	*12.50*	43.23	*42.27*	11.17	*14.40*	10.91	10.21	
10.62	*12.50*	43.95	*42.27*	11.74	*14.40*	9.41	11.37	
10.35	*12.50*	44.14	*42.27*	13.63	*14.40*	9.22	11.07	12.09
5.83	*5.75*	34.61	*33.09*	26.17	*29.12*	9.44	16.95	
4.72	*5.75*	34.98	*33.09*	28.36	*29.12*	9.16	15.65	
5.18	*5.75*	41.75	*33.09*	21.93	*29.12*	8.33	14.12	
5.24	*5.75*	37.11	*33.09*	25.49	*29.12*	8.98	15.57	51.58
9.60	*9.90*	45.77	*45.59*	12.86	*13.67*	9.74	11.03	
11.52	*9.90*	46.75	*45.59*	9.95	*13.67*	8.14	11.39	
12.30	*9.90*	47.76	*45.59*	9.43	*13.67*	9.12	8.76	
7.51	*9.90*	51.31	*45.59*	8.03	*13.67*	8.92	10.23	
10.63	*9.90*	54.12	*45.59*	7.52	*13.67*	9.26	7.09	
10.31	*9.90*	49.14	*45.59*	9.56	*13.67*	9.04	9.70	None

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Wall Rice Milling Co., **Lake Charles, La.**	4	926	9.63	*9.38*
	2	1357	7.75	*9.38*
Rice Bran, No. 1.	5	1452	10.25	*9.38*
	3	1566	8.06	*9.38*
	1	1970	13.69	*9.38*
Average	15		9.87	*9.38*
National Rice Mill, **New Orleans, La.**	2	782	8.87	*7.04*
Rice Hog Feed.	1	1532	9.06	*7.04*
Rice Screenings, containing weed seeds, mostly smartweed and grass.				
Average	3		8.97	*7.04*

RICE

Abbeville Rice Milling Co., Ltd., **Abbeville, La.**	4	1157	11.81	*0.10*
	1	1594	11.00	*0.10*
Rice Polish.				
Average	5		11.41	*0.10*
Conover Rice Milling Co., Ltd.,	2	765	10.06	*10.00*
Mermentau, La.	1	1052	11.44	*10.00*
Rice Polish.	5	1143	10.25	*10.00*
	2	1279	11.38	*10 00*
	1	1713	10.90	*10.00*
Average	11		10.81	*10.00*
Crowley Rice Milling Co., **Crowley, La.** Rice Polish.	1	1593	11.13	*12.18*
Donaldsonville Rice Milling Co., **Donaldsonville, La.** Rice Polish.	1	1698	12.18	*13.88*
Egan Rice Milling Co., Ltd., **Egan, La.** Rice Polish.	2	992	11.69	*10.00*

BRAN.

Fat % Found	Fat % Guaranteed	Carbohydrates % Found	Carbohydrates % Guaranteed	Fiber % Found	Fiber % Guaranteed	Water % Found	Ash % Found	Hulls % Found
8.60	*8.80*	39.03	*45.47*	21.18	*16.55*	9.32	12.24	
8.15	*8.80*	45.95	*45.47*	17.75	*16.55*	8.11	12.29	
8.62	*8.80*	41.67	*45.47*	17.14	*16.55*	10.26	12.06	
5.04	*8.80*	38.18	*45.47*	27.02	*16.55*	7.25	14.45	
8.65	*8.80*	45.89	*45.47*	13.90	*16.55*	9 10	8.77	
7.81	*8.80*	42.16	*45.47*	19.39	*16.55*	8.81	11.96	31.27
1.65	*0.04*	75.15	*58.00*	0.71	*10.00*	12.62	1.00	
1.27	*0.04*	73.91	*58.00*	3.15	*10.00*	11.30	1.31	
1.46	*0.04*	74.53	*58.00*	1.93	*10.00*	11.96	1.15	

POLISH.

6.68	*0.06*	64.87	*65.00*	1.93	*0.10*	10.60	4.11
5.17	*0.06*	68.19	*65.00*	2.40	*0.10*	9.40	3.84
5.92	*0.06*	66.53	*65.00*	2.16	*0.10*	10.00	3.98
5.37	*8.00*	70.23	*50.00*	1.55	*3.00*	10.14	2.65
8.89	*8.00*	63.08	*50.00*	1.57	*3.00*	10.48	4.54
5.58	*8.00*	69.33	*50.00*	1.56	*3.00*	10.37	2.91
6.65	*8.00*	68.43	*50.00*	1.20	*3.00*	9.07	3.27
5.00	*8.00*	70.07	*50.00*	1.51	*3.00*	9.37	3.15
.30	*8.00*	68.23	*50.00*	1.48	*.00*	9.88	3.30
6.46	*10.75*	67.03	*59.37*	2.21	*3.00*	9.55	3.63
4.16	*4.20*	67.25	*62.75*	3.09	*4.73*	9.84	3.48
7.01	*6.00*	66.13	*65.00*	1.61	*1.00*	9.97	3.59

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Empire Rice Milling Co., **New Orleans, La.** Rice Polish.	3	762	11.38	10.50
	1	880	11.38	10.50
	2	1087	11.06	10.50
	1	1968	12.50	10.50
	1	2089	10.81	10.50
Average	8		11.42	10.50
Eureka Rice Milling Co., **Esterwood, La.** Rice Polish.	1	804	12.00	12.75
Gueydan Rice Milling Co., Ltd., **Gueydan, La.** Rice Polish.	2	1152	11.56	0.60
Gulf Rice Milling Co., **Welsh, La.** Rice Polish.	1	824	12.00	12.00
	3	1266	11.31	12.00
	1	1757	12.03	12.00
Average	5		11.78	12.00
Haspel & Davis, **New Orleans, La.** Rice Polish.	2	889	11.19	11.37
Hunter Rice Milling Co., **Crowley, La.** Rice Polish.	4	1196	11.25	10.88
Iota Rice Milling Co., **Iota, La.** Rice Polish.	2	1088	10.94	10.00
Jennings Rice Milling Co., **Welsh, La.** Rice Polish.	2	768	11.94	10.00
	2	1006	11.31	10.00
	1	1050	11.00	10.00
	2	1330	10.94	10.00
	1	1866	11.63	10.00
Average	8		11.36	10.00
Jennings Rice Milling Co., **Jennings, La.** Rice Polish.	2	1060	10.50	10.00
	1	1367	10.19	10.00
	2	1645	12.19	10.00
Average	5		10.96	10.00

POLISH.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guarantee	% Found	% Guaranteed	% Found	% Found
7.19	*7.50*	66.59	*65.42*	1.82	*1.25*	9.03	3.99
8.92	*7.50*	63.18	*65.42*	1.84	*1.25*	10.42	4.26
7.01	*7.50*	67.07	*65.42*	1.22	*1.27*	10.15	3.49
7.35	*7.50*	65.78	*65.42*	1.93	*1.25*	8.40	4.04
7.27	*7.50*	66.65	*65.42*	1.54	*1.25*	9.62	4.11
7.54	*7.50*	65.85	*65.42*	1.67	*1.25*	9.54	3.98
7.97	*9.11*	63.18	*61.05*	2.08	*1.87*	10.56	4.21
8.23	*0.06*	63.58	*65.00*	3.09	*0.10*	9.17	4.37
5.50	*6.00*	67.18	*67.00*	2.09	*1.00*	10.36	2.87
5.94	*6.00*	66 60	*67.00*	2.53	*1.00*	9.68	3.94
9.28	*6.00*	58.51	*67.00*	3.90	*1.00*	9.33	6.95
6.91	*6.00*	64.10	*67.00*	2.84	*1.00*	9.79	4.58
9.18	*6.25*	63.04	*65.88*	1.30	*1.25*	10.72	4.57
9.69	*9.91*	62.70	*59.02*	1.09	*3.93*	9.01	6.26
7.21	*6.00*	66.79	*65.00*	1.68	*1.00*	9.84	3.54
8.18	*6.00*	65.35	*65.00*	1.74	*1.00*	9.38	3.41
7.98	*6.00*	64.50	*65.00*	1.83	*1.00*	10.49	3.89
7.11	*6.00*	65.04	*65.00*	2.61	*1.00*	10.21	4.03
7.01	*6.00*	66.88	*65.00*	1.97	*1.00*	9.77	3.43
5.20	*6.00*	65.38	*65.00*	2.87	*1.00*	9.70	5.22
7.10	*6.00*	65.43	*65.00*	2.20	*1.00*	9.91	4.00
6.18	*6.00*	68.59	*65.00*	1.38	*1.00*	10.24	3.11
4.45	*6.00*	70 98	*65.00*	1.57	*1.00*	9.49	3.32
5.58	*6.00*	69.07	*65.00*	1.45	*1.00*	9.30	2.41
5.40	*6.00*	69.54	*65.00*	1.47	*1.00*	9.68	2.95

RICE

Name of Manufacturer or Jobber and Brand.	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Jones Bros., **Crowley, La.** Rice Polish.	1 1	1046 1731	10.50 11.56	*10.00* *10.00*
Average	2		11.03	*10.00*
Lake Arthur Rice Milling Co., **Lake Arthur, La.** Rice Polish.	1	1406	10.56	*10.00*
Lake Charles Rice Milling Co., **Lake Charles, La.** Rice Polish.	3 1 1 1	981 1537 1761 1867	11.69 11.44 11.71 12.88	*12.50* *12.50* *12.50* *12.50*
Average	6		11.94	*12.50*
Rice Polish.	1 1	994 1370	12.94 11.31	*12.00* *12.00*
Average	2		12.13	*12.00*
Lawrence & Hamilton, **New Orleans, La.** Rice Polish.	1	1595	11.06	*11.00*
Leona Rice Milling Co., **New Orleans, La.** Rice Polish.	1	1373	12.43	*10.13*
Levy Rice Milling Co., **New Orleans, La.** Rice Polish.	1 1 1	840 1760 2088	11.38 13.18 13.75	*11.01* *11.01* *11.01*
Average	3		12.77	*11.01*
Louisiana Irrigation and Milling Co., **Morse, La.** Rice Polish.	1 1	1070 1405	11.00 10.81	*12.00* *12.00*
Average	2		10.91	*12.00*
Louisiana Irrigation and Milling Co., **Jennings, La.** Rice Polish.	2	1300	10.69	*12.00*
Louisiana Irrigation and Milling Co., **Roanoke, La.** Rice Polish.	1	995	12.13	*12.00*

POLISH.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	Found	% Guaranteed	% Found	% Found
5.37	*0.06*	67.43	*65.00*	2.12	*0.01*	10.70	3.88
5.66	*0.06*	67.19	*65.00*	2.03	*0.01*	8.88	4.68
5.52	*0.06*	67.31	*65.00*	2.07	*0.01*	9.79	4.28
5.83	*6.00*	67.62	*65.00*	2.01	*1.50*	10.76	3.22
6.97	*7.00*	66.88	*66.25*	1.47	*2.50*	9.43	3.56
8.38	*7.00*	64.79	*66.25*	1.81	*2.50*	9.54	4.04
7.65	*7.00*	65.48	*66.25*	1.86	*2.50*	9.47	3.83
5.45	*7.00*	65.27	*66.25*	3.30	*2.50*	9.08	4.02
7.11	*7.00*	65.60	*66.25*	2.11	*2.50*	9.38	3.86
7.96	*10.00*	62.70	*60.00*	2.00	*3.00*	10.60	3.80
7.08	*10.00*	65.98	*60.00*	1.62	*3.00*	10.25	3.76
7.52	*10.00*	64.34	*60.00*	1.81	*3.00*	10.42	3.78
4.05	*7.00*	70.21	*56.00*	1.44	*8.00*	10.28	2.96
9.18	*4.77*	62.09	*69.28*	2.41	*2.20*	9.41	4.48
6.21	*8.37*	67.19	*63.41*	1.15	*1.07*	10.45	3.62
8.54	*8.37*	61.77	*63.41*	2.84	*1.07*	9.57	4.10
6.02	*8.37*	64.15	*63.41*	2.15	*1.07*	10.02	3.91
6.92	*8.37*	64.37	*63.41*	2.04	*1.07*	10.02	3.88
8.10	*0.06*	61.82	*65.00*	3.82	*0.01*	10.18	5.08
7.10	*0.06*	62.88	*65.00*	3.63	*0.01*	11.05	4.53
7.60	*0.06*	62.35	*65.00*	3.72	*0.01*	10.61	4.81
5.94	*0.06*	70.86	*65.00*	0.96	*0.01*	8.68	2.87
5.89	*0.06*	66.12	*65.00*	1.45	*0.01*	10.41	4.00

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Morse Rice Milling Co., Ltd.,	1	833	11.00	*9.62*
Morse, La.	1	1082	10.81	*9.62*
Rice Polish.				
Average	2		10.91	*9.62*
Mutual Rice Milling Co.,				
Gueydan, La.	2	1059	10.38	*12.56*
Rice Polish.	2	1408	10.50	*12.56*
Average	4		10.44	*12.56*
National Rice Milling Co.,	2	785	11.81	*11.06*
Crowley, La.	1	1372	12.81	*11.06*
Rice Polish.				
Average	3		12.31	*11.06*
New Iberia Rice Milling Co.,				
New Iberia, La.	2	813	10.56	*10.19*
Rice Polish.				
Orleans Rice Milling Co.,	3	783	11.94	*10.50*
New Orleans, La.	3	968	11.06	*10.50*
Rice Polish.	1	2156	10.19	*10.50*
Average	7		11.06	*10.50*
People's Independent Rice Milling Co.,	3	1120	11.44	*12.75*
Crowley, La.	1	1618	12.34	*12.75*
Rice Polish.				
Average	4		11 89	*12.75*
Planters' Rice Milling Co., Ltd.,	1	997	13.78	*15.08*
Abbeville, La.	2	1151	14.38	*15.08*
Rice Polish.				
Average	3		14.08	*15.08*
Rayne Rice Milling Co.,	2	1096	10.13	*10.00*
Rayne, La.,				
Rice Polish.				

POLISH.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed.	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
7.62	*8.75*	65.78	*69.97*	1.95	*4.50*	9.56	4.09
6.40	*8.75*	67.71	*69.97*	2.18	*4.50*	9.19	3.71
7.01	*8.75*	66.74	*69.97*	2.06	*4.50*	9.38	3.90
4.64	*5.88*	70.93	*65.01*	1.29	*1.41*	9.74	3.02
7.00	*5.88*	67.87	*65.01*	1.46	*1.41*	9.55	3.62
5.82	*5.88*	69.40	*65.01*	1.38	*1.41*	9.64	3.32
10.48	*9.07*	59.66	*62.12*	2.63	*2.25*	10.66	4.76
7.73	*9.07*	62.39	*62.12*	2.54	*2.25*	10.84	3.89
9.11	*9.07*	61.03	*62.12*	2.58	*2.25*	10.65	4.32
7.30	*9.22*	65.07	*62.97*	1.52	*1.25*	10.84	4.71
7.42	*7.00*	64.01	*68.09*	1.33	*0.50*	11.30	4.00
5.73	*7.00*	70.00	*68.09*	1.13	*0.50*	9.58	2.50
5.82	*7.00*	69.36	*68.09*	1.27	*0.50*	9.69	3.67
6.33	*7.00*	67.79	*68.09*	1.24	*0.50*	10.19	3.39
7.45	*10.67*	63.23	*61.05*	2.92	*1.87*	10.25	4.71
6.89	*10.67*	61.49	*61.05*	3.66	*1.87*	9.77	5.85
7.17	*10.67*	62.36	*61.05*	3.29	*1.87*	10.01	5.28
9.40	*8.34*	58.84	*56.23*	2.42	*3.00*	10.63	4.93
10.70	*8.34*	58.33	*56.23*	2.67	*3.00*	9.39	4.53
10.05	*8.34*	58.59	*56.23*	2.54	*3.00*	10.01	4.73
6.37	*6.00*	69.15	*65.00*	1.13	*1.00*	9.55	3.67

RICE

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
A. Socola, **New Orleans, La.** A. S. Rice Polish.	8	684	11.06	*9.44*
	4	873	12.31	*9.44*
	3	1461	10.50	*9.44*
	1	1717	14.25	*9.44*
	1	1957	11.75	*9.44*
	1	2083	11.19	*9.44*
	3	2130	11.31	*9.44*
Average	21		11.77	*9.44*
Southern Rice Milling Co., **New Orleans, La.** Rice Polish.	1	816	10.25	*9.62*
U. S. Rice Milling Co., Ltd., **Crowley, La.** Rice Polish.	2	991	11.50	*11.25*
	4	1191	11.81	*11.25*
	2	1462	9.69	*11.25*
	2	1546	10.63	*11 25*
	1	1871	10.88	*11 25*
Average	11		10.90	*11.25*
Wall Rice Milling Co., **Lake Charles, La.** Rice Polish.	2	1089	11.63	*14.30*
	2	1397	11.81	*14.30*
	2	1523	11.00	*14.30*
Average	6		11.48	*14.30*

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Akin-Erskine Milling Co., **Evansville, Ind.** Wheat Bran	1	1616	15.56	*15.66*
Arms & Kidder, **Kansas City, Mo.** Wheat Bran.	1	851	9.1	*14.85*
Atchison Live Stock Co., **Atchison, Kan.** Wheat Bran.	3	868	11.31	*.00*
	4	1019	14.63	*.00*
	2	1458	13.63	*.00*
	7	1883	14.56	*.00*
	6	2006	15.88	*.00*
	2	2115	14.87	*.00*
Average	24		14.15	*3.00*

POLISH.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
8.00	*7.73*	64.03	*67.68*	1.87	*1.83*	10.27	4.77
6.17	*7.73*	65.78	*67.68*	1.40	*1.83*	11.06	3.28
6.51	*7.73*	66.02	*67.68*	1.77	*1.83*	11.33	3.87
5.33	*7.73*	64.38	*67.68*	2.09	*1.83*	10.30	3.65
6.95	*7.73*	63.24	*67.68*	4.10	*1.83*	9.90	4.06
7.16	*7.73*	65.05	*67.68*	2.16	*1.83*	9.93	4.51
7.39	*7.73*	65.08	*67.68*	1.85	*1.83*	9 82	4.55
6.79	*7.73*	64.79	*67.68*	2.18	*1.83*	10.37	4.09
6.80	*6.25*	66.21	*69.22*	1.79	*1.25*	10.43	4.52
7.04	*11.22*	66.81	*61.54*	1.66	*2.77*	9.87	3.12
9.77	*11.22*	61.84	*61.54*	2.27	*2.77*	9.78	4.53
7.40	*11.22*	67.06	*61.54*	1.79	*2.77*	10.46	3.60
7.38	*11 22*	65.64	*61.54*	1.83	*2.77*	10.96	3.56
7.95	*11.22*	66.17	*61.54*	2.90	*2.77*	8.45	3.65
7.91	*11.22*	65.51	*61.54*	2.09	*2.77*	9.90	3.69
7.76	*12.00*	65.72	*57.95*	1.90	*2.05*	9.21	3.78
7.36	*12.00*	65.05	*57.95*	1.95	*2.05*	10.54	3.29
7.63	*12.00*	64.38	*57.95*	2.47	*2.05*	10.63	3.89
7.58	*12.00*	65.05	*57.95*	2.11	*2.05*	10.12	3.66

BRAN.

3.89	*3.17*	54.33	*56.84*	9.56	10.22	10.24	6.42
3.98	*3.58*	50.72	*54.60*	8.69	10.00	11.54	5.88
3.95	*3.00*	54.76	*50.00*	10.08	*20.00*	12.52	7.38
4.03	*3.00*	52.63	*50.00*	11.18	*20.00*	10.36	7.17
3.78	*3.00*	53.87	*50.00*	10.48	*20.00*	11.40	6.84
3.75	*3.00*	50.05	*50.00*	12.50	*20.00*	11.80	7.34
4.58	*3.00*	51.45	*50.00*	11.58	*20.00*	9.35	7.16
3.89	*3.00*	52.55	*50.00*	10.96	*20.00*	10.89	6.84
4.00	*3.00*	52.55	*50.00*	11.13	*20.00*	11.05	7.12

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Aurora Milling Co., **Aurora, Me.** Jerrett Wheat Bran.	5	928	16.56	*16.00*
	10	1028	16.44	*16.00*
	5	1184	15.81	*16.00*
	1	1374	15.56	*16.00*
	1	1748	16.12	*16.00*
	2	1924	15.81	*16.00*
Average	24		16.05	*16.00*
C. Becker Milling Co., **Red Bud, Ill.** Wheat Bran.	4	1554	14.84	*14.85*
	7	1247	15.59	*14.85*
	3	1418	14.75	*14.85*
	2	1705	15.31	*14.85*
	1	2173	14.63	*14.85*
Average	17		15.02	*14.85*
The Blair Milling Co., **Atchison, Kan.** Blair's Bran.	2	888	13.63	*13.93*
	8	686	13.44	*13.93*
	4	1259	15.19	*13.93*
	2	1550	14.93	*13.93*
	3	1810	13.81	*13.93*
	4	2095	15.13	*13.93*
	1	2087	14.25	*13.93*
Average	24		14.34	*13.93*
Blackwell Milling Co., **Blackwell, Okla.** Bran.	2	1667	17.63	*15.00*
	1	1845	18.25	*15.00*
Average	3		17.94	*15.00*
Burrus Mill and Elevator Co., **Fort Worth, Tex.** Burrus Wheat Bran.	3	738	16.88	*15.19*
	5	927	17.43	*15.19*
	10	1133	16.44	*15.19*
	2	1329	17.06	*15.19*
	3	1571	17.06	*15.19*
	3	1803	16.37	*15.19*
	2	1934	15.31	*15.19*
	1	2078	16.63	*15.19*
	2	2146	16.94	*15.19*
Average	31		16.68	*15.19*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	Guaranteed	% Found	% Found
4.40	3.13	52.93	53.00	8 67	9.00	11.58	5.86
4.53	3.13	53.94	53.00	9.23	9.00	10.07	5.79
4.52	3.13	55.88	53.00	8.28	9.00	10.28	5.23
3.51	3.13	57.59	53.00	8.12	9.00	10.50	4.72
4.57	3.13	55.33	53.00	8.60	9.00	10.05	5.33
4.03	3.13	56.09	53.00	9.10	9.00	9.58	5.39
4.26	3.13	55.29	53.00	8.67	9.00	10.34	5.39
4.11	3.58	55.31	54.60	9.19	10.00	10.22	6.33
4.31	3.58	54.99	54.60	9.08	10.00	10.11	5.92
4.05	3.58	53.81	54.60	9.22	10.00	11.86	6.31
4.46	3.58	55.56	54.60	9.21	10.00	9.59	5.87
4.22	3.58	53.50	54.60	9.38	10.00	12.03	6.24
4.23	3.58	54.64	54.60	9.22	10.00	10.76	6.13
3.93	3.50	53.88	56.84	10.67	10.59	11.10	6.79
4.23	3.50	55.85	56.84	9.64	10.59	10.41	6.43
4.18	3.50	55.24	56.84	9.92	10.59	9.01	6.46
4.26	3.50	55.53	56.84	8.24	10.59	11.54	5.50
4.58	3.50	55.79	56.84	9.57	10.59	9.60	6.65
4.20	3.50	51.21	56.84	9.86	10.59	13.02	6.58
4.27	3.50	54.72	56.84	10.15	10.59	9.97	6.64
4.24	3.50	54.60	56.84	9.72	10.59	10.66	6.44
4.02	5.00	53.59	47.00	8 89	10.00	10.06	5.81
4.12	5.00	53.04	47.00	9.75	10.00	9.24	5.60
4.07	5.00	53.31	47.00	9.32	10.00	9.65	5.71
5.08	4.72	54.13	54.19	7.52	7.90	10.79	5.60
4.40	4.72	53.49	54.19	7.90	7.90	10.69	6.09
4 54	4.72	55 02	54.19	7.59	7.90	11.30	5.11
4.07	4.72	54.63	54.19	8.47	7.90	10.31	5.46
4.09	4.72	56.98	54.19	7.30	7.90	9.56	5.01
3.97	4.72	57.20	54.19	7.36	7.90	9.98	5.12
4.28	4.72	55.71	54.19	8.20	7.90	10.98	5.52
3.70	4.72	57.19	54.19	6.82	7.90	10.77	4.89
4.24	4.72	56.23	54.19	7.41	7.90	10.43	4.75
4.26	4.72	55.62	54.19	7.62	7.90	10.54	5.28

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	 % Guaranteed
A. J. Butte Milling Co., **Kansas City, Mo.** Wheat Bran.	1	1195	15.06	*14.85*
	1	2084	15.81	*14.85*
Average	2		15.44	*14.85*
Wheat Bran.	1	1611	16.25	*14.00*
The Cain Mill Co., **Atchison, Kan.** Cain's Bran.	5	965	13.56	*13.51*
	2	1124	13.44	*13.51*
	1	1587	14.13	*13.51*
	1	1764	14.43	*13.51*
	1	1952	15.50	*13.51*
	3	2145	14.93	*13.51*
Average	13		14.33	*13.51*
Caldwell Milling Co., **Caldwell, Kan.** Wheat Bran.	2	950	16.56	*15.06*
	1	1486	14.94	*15.06*
Average	3		15.75	*15.06*
Cape County Milling Co., **Jackson, Mo.** Wheat Bran.	10	1417	15.81	*14.08*
	5	1634	16.81	*14.08*
	2	1824	15.87	*14.08*
Average	17		16.16	*14.08*
Carbondale Mill & Elevator Co., **Carbondale, Ill.** Wheat Bran.	2	1945	15.25	*14.55*
Charleston Milling Co., **Charleston, Mo.** Wheat Bran.	1	850	16.75	*13.10*
	3	1123	14.38	*13.10*
	7	1254	15.13	*13.10*
	4	1360	14.56	*13.10*
	3	1624	14.56	*13.10*
Average	18		15.08	*13.10*
Cherokee Milling & Elevator Co., **Cherokee, Okla.** Wheat Bran.	1	898	17.19	*14.85*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Foun	% Guaranteed.	% Found	% Found
4.68	*3.58*	55.80	*54.60*	8.95	*10.00*	9.89	5.62
4.41	*3.58*	54.63	*54.60*	8.93	*10.00*	10.15	6.07
4.54	*3.58*	55.22	*54.60*	8.94	*10.00*	10.02	5.84
4.38	*4.50*	52.14	*49.00*	9.73	*10.00*	11.16	6.34
4.22	*3.14*	53.92	*55.13*	9.47	*9.15*	12.27	6.56
4.39	*3.14*	53.79	*55.13*	10.02	*9.15*	11.90	6.46
3.90	*3.14*	55.53	*55.13*	10.00	*9.15*	10.08	6.36
4.22	*3.14*	53.51	*55.13*	10.41	*9.15*	10.83	6.60
4.60	*3.14*	59.94	*55.13*	5.65	*9.15*	10.45	3.86
4.54	*3.14*	53.99	*55.13*	9.75	*9.15*	10.69	6.10
4.31	*3.14*	55.13	*55.13*	9.21	*9.15*	11.03	5.99
3.74	*3.34*	53.20	*52.04*	8.06	*10.08*	12.96	5.48
3.49	*3.34*	52.14	*52.04*	11.02	*10.08*	10.99	7.42
3.62	*3.34*	52.67	*52.04*	9.54	*10.08*	11.97	6.45
4.36	*4.70*	55.82	*55.36*	7.09	*7.47*	11.66	5.26
4.46	*4.70*	56.17	*55.36*	7.47	*7.47*	10.18	4.91
4.30	*4.70*	57.63	*55.36*	7.33	*7.47*	9.27	5.60
4.37	*4.70*	56.54	*55.36*	7.30	*7.47*	10.37	5.26
3.53	*3.10*	51.98	*54.40*	10.89	*8.90*	11.90	6.45
4.90	*4.75*	51.79	*54.50*	8.70	*9.80*	11.19	6.67
4.78	*4.75*	56.47	*54.50*	7.50	*9.80*	11.29	5.58
5.61	*4.75*	56.83	*54.50*	7.35	*9.80*	9.17	5.91
4.50	*4.75*	54.33	*54.50*	8.58	*9.80*	11.78	6.25
4.78	*4.75*	54.67	*54.50*	9.40	*9.80*	10.00	6.59
4.91	*4.75*	54.82	*54.50*	8.30	*9.80*	10.69	6.20
4.08	*3.58*	51.56	*54.60*	9.43	*10.00*	10.84	6.90

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			Found	% Guaranteed
Chapin & Co., **St. Louis, Mo.** Pure Wheat Bran.	5	860	13.13	*14.00*
	4	714	15.44	*14.00*
	4	754	14.88	*14.00*
	4	1176	15.25	*14.00*
	4	1305	15.74	*14.00*
	2	1708	15.31	*14.00*
	7	1796	15.46	*14.00*
	1	1963	15.19	*14.00*
	4	2008	14.69	*14.00*
	2	2117	14.93	*14.00*
Average	37		15.00	*14.00*
Chopman Milling Co., **Sherman, Tex.** Wheat Bran.	1	790	14.63	*14.13*
	1	1213	15.06	*14.13*
Average	2		14.85	*14.13*
H. C. Cole Milling Co., **Chester, Ill.** Bran.	3	1349	14.93	*14.00*
Cooley Milling Co., **Siloam Springs, Ark.** Wheat Bran.	1	1072	16.56	*15.00*
	2	1321	14.81	*15.00*
Average	3		15.69	*15.00*
Cumberland Mills, **Nashville, Tenn.** Bran.	2	733	13.38	*14.85*
Cumberland and Liberty Mills, **Nashville, Tenn.** Pure Wheat Bran.	6	1128	15.44	*14.50*
	2	1487	14.87	*14.50*
	1	1612	15.75	*14.50*
Average	9		15.36	*14.50*
Davis Milling Co., **St. Joseph, Mo.** Pure Wheat Bran.	7	685	13.94	*13.00*
	2	1078	14.13	*13.00*
	3	1263	13.69	*13.00*
	5	1423	14.31	*13.00*
	1	1755	14.53	*13.00*
	5	1784	14.88	*13.00*
	4	2002	15.25	*13.00*
	2	2124	16.19	*13.00*
Average	29		14.62	*13.00*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.32	*3.00*	54.78	*40.00*	9.78	*5.00*	11.44	6.55
4.42	*3.00*	54 12	*40.00*	9.08	*5.00*	10.89	6.05
4.43	*3.00*	54.28	*40.00*	9.15	*5.00*	11.03	6.23
6.40	*3.00*	53.97	*40.00*	8.37	*5.00*	10.38	5.63
4.15	*3.00*	56.70	*40.00*	8.95	*5.00*	8.49	5.96
3.94	*3.00*	55.96	*40.00*	8.73	*5.00*	10.16	5.90
4.29	*3.00*	54.97	*40.00*	8.92	*5.00*	10.33	6.03
4.73	*3.00*	54.02	*40.00*	9.45	*5.00*	10.68	5.93
4.58	*3.00*	54.61	*40.00*	9.95	*5.00*	9.80	6.37
4.35	*3.00*	53.78	*40.00*	8.95	*5.00*	11.82	6.17
4.56	*3.00*	54.72	*40.00*	9.14	*5.00*	10.50	6.08
4.19	*4.41*	55.14	*57.83*	9.29	*6.95*	10.18	6.57
4.91	*4.41*	57.26	*57.83*	7.61	*6.95*	9.93	5.23
4.55	*4.41*	56.20	*57.83*	8.45	*6.95*	10.05	5.90
3.81	*3.75*	56.42	*50.00*	8.06	*10.00*	10.74	6.04
3.94	*4.00*	58.03	*50.00*	6.83	*7.00*	10 04	4.60
3.71	*4.00*	59.83	*50.00*	6.39	*7.00*	11.07	4.19
3.83	*4.00*	58.93	*50.00*	6.61	*7.00*	10.55	4.39
4.72	*3.58*	55.82	*54.60*	7.29	*10.00*	10.57	5.22
4.11	*4.00*	52.68	*50.00*	9.32	*9.50*	11.58	6.87
3.96	*4.00*	54.14	*50.00*	9.59	*9.50*	11.27	6.17
4.16	*4.00*	53.81	*50.00*	9.45	*9.50*	10.55	6.28
4.08	*4.00*	53.54	*50.00*	9.45	*9.50*	11.13	6.44
4.38	*4.00*	57.24	*53.00*	7.98	*9.00*	10.91	5.55
4.18	*4.00*	55.78	*53.00*	8.79	*9.00*	11.30	5.82
4.51	*4.00*	56.26	*53.00*	9.14	*9.00*	10.24	6.16
4.36	*4.00*	55.84	*53.00*	8.34	*9.00*	11.39	5.76
4.51	*4.00*	56.80	*53.00*	8.41	*9.00*	10.47	5.28
4.42	*4.00*	55.48	*53.00*	8.96	*9.00*	10.18	6.08
4.50	*4.00*	51.82	*53.00*	10.65	*9.00*	11.08	6.70
4.44	*4.00*	54.74	*53.00*	8.56	*9.00*	10.06	6.01
4.41	*4.00*	55.50	*53.00*	8.85	*9.10*	10.70	5.92

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Dean Mill Co., **Ava, Ill.** Wheat Bran.	1	1661	14.87	*13.00*
Diamond Mills Co., **Sherman, Texas.** Wheat Bran.	5	706	14.69	*15.00*
	1	1413	16.25	*15.00*
Average	6		15.47	*15.00*
Enid Mill & Elevator Co., **Enid, Okla.** Wheat Bran.	1	1740	18.18	*16.30*
R. H. Fawcett Co., **St. Joseph, Mo.** Wheat Bran.	1	1996	16.13	*12.12*
Lev. Fowler, **Shreveport, La.** Mixed Bran.	4	1578	11.50	*10.97*
	4	1174	14.81	*10.97*
	5	1261	13.75	*10.97*
	5	1444	14.00	*10.97*
	2	1821	12.93	*10.97*
	1	1987	12.25	*10.97*
Average	21		13.21	*10.97*
Lev. Fowler, **Kansas City, Mo.** **Wheat Bran.**	2	1091	15.25	*7.40*
	2	1323	15.38	*7.40*
	2	1522	15.81	*7.40*
	2	1706	13.87	*7.40*
	3	1809	14.68	*7.40*
	3	1923	14.06	*7.40*
Average	14		14.84	*7.40*
Fowler Commission Co., **Rosedale, Kan.** Wheat Bran.	1	2091	14.75	*14.13*
H. L. Halliday Milling Co., **Cairo, Ill.** Pure Wheat Bran.	2	1017	16.50	*14.00*
	4	700	15.63	*14.00*
Average	6		16.07	*14.00*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.20	*3.50*	55.90	*35.00*	9.13	*15.00*	9.11	6.79
4.41	*5.00*	53.67	*53.00*	9.67	*8.82*	11.03	6.53
4.61	*5.00*	54.37	*53.00*	7.41	*8.82*	12.18	5.18
4.51	*5.00*	54.02	*53.00*	8.54	*8.82*	11.60	5.86
3.74	*3.70*	53.20	*59.80*	9.41	*7.50*	9.62	5.85
3.40	*5.89*	49.87	*60.87*	11.80	*2.96*	11.48	7.32
2.91	*5.72*	68.82	*48.41*	4.19	*16.86*	9.33	3.25
6.09	*5.72*	51.49	*48.41*	10.01	*16.86*	10.79	6.81
7.69	*5.72*	51.86	*48.41*	10.43	*16.86*	8.81	7.46
8.01	*5.72*	51.22	*48.41*	8.27	*16.86*	11.91	6.59
3.34	*5.72*	61.78	*48.41*	6.89	*16.86*	10.48	4.58
4.00	*5.72*	52.74	*48.41*	12.58	*16.86*	10.55	7.88
5.34	*5.72*	56.33	*48.41*	8.72	*16.86*	10.31	6.09
4.64	*4.08*	55.03	*49.00*	8.49	*14.18*	10.42	6.17
4.15	*4.08*	56.60	*49.00*	8.69	*14.18*	9.69	5.49
4.22	*4.08*	53.40	*49.00*	8.83	*14.18*	12.06	5.68
4.00	*4.08*	54.77	*49.00*	10.28	*14.18*	10.33	6.75
4.31	*4.08*	53.57	*49.00*	10.58	*14.18*	10.31	6.55
3.95	*4.08*	55.93	*49.00*	9.45	*14.18*	10.43	6.18
4.21	*4.08*	54.88	*49.00*	9.39	*14.18*	10.54	6.14
4.41	*3.00*	55.55	*55.31*	8.98	*10.31*	10.25	6.06
4.62	*4.00*	54.29	*55.00*	7.91	*8.50*	10.62	6.06
4.50	*4.00*	54.60	*55.00*	7.54	*8.50*	11.67	6.06
4.56	*4.00*	54.45	*55.00*	7.72	*8.50*	11.14	6.06

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed.
Higginsville Milling Co., **Higginsville, Mo.** Wheat Bran.	3	1445	15.61	*14.23*
	1	1765	15.00	*14.23*
	3	1919	15.13	*14.23*
	1	2076	14.69	*14.23*
	1	2169	16.38	*14.23*
Average	9		15.36	*14.23*
R. J. House & Co., **Kansas City, Mo.** Wheat Bran.	1	1215	14.06	*17.70*
Hunter Bros. Milling Co., **St. Louis, Mo.** Wheat Bran.	8	773	16.31	*14.85*
	1	1014	15.56	*14.85*
Average	9		15.94	*14.85*
Pure Wheat Bran.	2	1320	15.25	*14.00*
Wheat Bran.	1	800	15.68	*14.00*
Wheat Bran.	1	1846	15.88	*13.00*
Hunter Bros. Milling Co., **Kansas City, Mo.** Wheat Bran.	1	1873	16.94	*12.50*
Wheat Bran.	4	743	16.31	*14.85*
	6	867	16.00	*14.85*
Average	10		16.15	*14.85*
Pure Wheat Bran.	5	1542	15.25	*14.00*
	10	1673	15.31	*14.00*
	2	1853	15.19	*14.00*
	1	1994	14.25	*14.00*
	7	2003	15.31	*14.00*
	4	2128	15.69	*14.00*
Average	29		15.17	*14.00*
Kansas City Seed & Grain Co., **Kansas City, Mo.** Wheat Bran.	2	1203	16.94	*15.40*
	1	1743	16.09	*15.40*
Average	3		16.52	*15.40*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.07	*2.60*	52.12	*54.39*	9.49	*12.87*	12.45	6.26
4.53	*2.60*	53.22	*54.39*	9.45	*12.87*	11.22	6.58
4.33	*2.60*	52.74	*54.39*	10.60	*12.87*	10.33	6.87
4.08	*2.60*	56.09	*54.39*	8.54	*12.87*	9.96	6.64
4.50	*2.60*	51.56	*54.39*	9.83	*12.87*	11.36	6.37
4.30	*2.60*	53.15	*54.39*	9.58	*12.87*	11.06	6.55
4.06	*5.70*	56.65	*50.09*	8.74	*10.40*	10.25	6.24
4.05	*3.58*	54.21	*54.60*	8.68	*10.00*	10.82	5.93
4.45	*3.58*	55.21	*54.60*	7.89	*10.00*	11.10	5.79
4.25	*3.58*	54.71	*54.60*	8.28	*10.00*	10.96	5.86
3.70	*3.50*	55.45	*54.00*	8.59	*10.00*	11.15	5.86
4.61	*3.00*	55.15	*40.00*	8.88	*5.00*	9.93	5.75
3.50	*3.50*	55.66	*35.00*	8.90	*10.00*	10.03	6.03
4.06	*2.75*	54.11	*51.60*	9.50	*12.00*	9.14	6.25
4.53	*3.58*	53.18	*54.69*	8.53	*10.00*	10.95	6.50
4.58	*3.58*	54.02	*54.69*	8.34	*10.00*	11.53	5.53
4.56	*3.58*	53.60	*54.69*	8.43	*10.00*	11.24	6.01
4.11	*3.50*	55.53	*54.00*	7.74	*10.00*	12.09	5.28
4.12	*3.50*	55.04	*54.00*	8.48	*10.00*	10.73	6.32
4.26	*3.50*	55.80	*54.00*	8.65	*10.00*	9.92	6.18
3.58	*3.50*	55.31	*54.00*	9.83	*10.00*	12.10	4.93
4.20	*3.50*	53.44	*54.00*	9.70	*10.00*	11.30	6.05
4.33	*3.50*	55.56	*54.00*	8.44	*10.00*	10.49	5.49
4.10	*3.50*	55.11	*54.00*	8.81	*10.00*	11.10	5.71
4.48	*4.00*	52.90	*62.90*	9.49	*9.00*	10.13	6.06
3.80	*4.00*	55.58	*62.90*	9.66	*9.00*	8.82	6.05
4.14	*4.00*	54.24	*62.90*	9.58	*9.00*	9.47	6.05

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	 % Guaranteed
Keller Grocery Co.,	1	1097	14.56	*14.00*
Monroe, La.				
Wheat Bran.				
Kelly-Lysle Milling Co.,				
Leavenworth, Kan.	5	1573	15.31	*15.04*
Pure Wheat Bran.	7	717	14.44	*15.04*
	6	1107	14.75	*15.04*
	8	1230	14.63	*15.04*
	13	862	14.25	*15.04*
	3	1363	14.50	*15.04*
	6	1443	14.50	*15.04*
	2	657	15.78	*15.04*
	2	1704	15.00	*15.04*
	2	1823	14.09	*15.04*
	7	1885	14.44	*15.04*
	3	2019	14.06	*15.04*
	6	2100	14.56	*15.04*
Average	70		14.64	*15.04*
Kelly Milling Co.,				
Kansas City, Mo.	3	956	16.19	*14.85*
Wheat Bran.	3	1260	16.31	*14.85*
	7	1154	16.56	*14.85*
	2	1544	15.44	*14.85*
	6	2017	15.25	*14.85*
	3	2122	15.63	*14.85*
	1	2175	16.00	*14.85*
Average	25		15.91	*14.85*
Wheat Bran.	2	1460	16.00	*15.00*
W. T. Kemper Elevator Co.,	4	1158	15.50	*14.50*
Kansas City, Mo.	4	720	14.88	*14.50*
Kemper Bran.	4	1018	15.94	*14.50*
	8	1431	14.75	*14.50*
	2	1647	16.38	*14.50*
	3	1807	16.06	*14.50*
	1	1984	13.75	*14.50*
	4	2020	15.19	*14.50*
Average	30		15.31	*14.50*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
5.13	*4.20*	51.49	*57.00*	9.82	*7.00*	11.79	7.21
3.55	*4.00*	54.04	*53.09*	9.99	*9.00*	10.00	7.11
4.22	*4.00*	55.75	*53.09*	9.48	*9.00*	9.48	6.63
4.73	*4.00*	54.76	*53.09*	8.76	*9.00*	11.01	5.99
4.32	*4.00*	54.52	*53.09*	9.99	*9.00*	10.06	6.48
4.03	*4.00*	53.76	*53.09*	10.19	*9.00*	11.17	6.60
4.48	*4.00*	56.77	*53.09*	8.43	*9.00*	9.63	6.19
4.13	*4.00*	53.07	*53.09*	9.07	*9.00*	13.06	6.17
5.25	*4.00*	52.90	*53.09*	9.02	*9.00*	10.17	6.88
3.97	*4.00*	53.56	*53.09*	9.78	*9.00*	10.26	7.43
4.02	*4.00*	54.45	*53.09*	10.22	*9.00*	10.32	6.90
4.00	*4.00*	53.75	*53.09*	9.25	*9.00*	11.70	6.86
4.07	*4.00*	52.94	*53.09*	10.36	*9.00*	11.93	6.64
4.05	*4.00*	52.27	*53.09*	9.80	*9.00*	13.03	6.29
4.22	*4.00*	54.04	*53.09*	9.56	*9.00*	10.91	6.63
4.06	*3.58*	52.12	*54.60*	9.30	*10.00*	12.28	6.05
4.33	*3.58*	57.23	*54.60*	7.41	*10.00*	9.39	5.33
4.42	*3.58*	54.75	*54.60*	7.91	*10.00*	10.67	5.69
4.03	*3.58*	55.93	*54.60*	7.99	*10.00*	10.90	5.71
4.50	*3.58*	54.12	*54.60*	9.65	*10.00*	10.60	5.88
4.27	*3.58*	55.25	*54.60*	8.37	*10.00*	10.77	5.71
4.62	*3.58*	52.39	*54.60*	9.41	*10.00*	11.97	5.61
4.32	*3.58*	54.54	*54.60*	8.58	*10.00*	10.94	5.71
.36	*4.25*	55.44	*54.00*	7.41	*9.00*	11.38	5.41
4.18	*5.60*	51.98	*50.40*	10.08	*13.50*	11.35	6.91
4.40	*5.60*	54.62	*50.40*	9.76	*13.50*	8.83	7.51
6.55	*5.60*	49.47	*50.40*	10 46	*13.50*	9.88	7.70
3.59	*5.60*	54 10	*50.40*	9.62	*13.50*	10.71	7.23
4.09	*5.60*	53.12	*50.40*	9.70	*13.50*	9.84	6.87
3.97	*5 60*	53.10	*50.40*	9.94	*13.50*	9.78	7.15
4.33	*5.60*	55.05	*50.40*	9.23	*13.50*	11.48	6.16
3.73	*5.60*	52.90	*50.40*	9.96	*13.50*	11.85	6.37
4.36	*5.60*	53.04	*50.40*	9.84	*13.50*	10.46	6.99

WHEAT

Name of Mannfacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guar- anteed
W. T. Kemper Elevator Co.,	7	746	16.56	*14.85*
Kansas City, Mo.	13	861	14.88	*14.85*
Wheat Bran.	5	949	16.44	*14.85*
	5	1110	17.00	*14.85*
	8	1126	16.42	*14.85*
	4	1318	16.13	*14.85*
	4	1467	14.87	*14.85*
	1	1601	14.86	*14.85*
	1	2090	15.69	*14.85*
	3	2091	15.81	*14 85*
	3	1802	14.62	*14.85*
	6	1891	14.63	*14.85*
	5	2126	16.81	*14.85*
Average	65		15.75	*14.85*
H. T. Lawler, M. & T. Co.,				
New Orleans, La.	1	1005	13.38	*14.85*
Fat Stock Pure Wheat Bran.	1	1613	14.13	*14.85*
Average	2		13.76	*14.85*
Leavenworth Milling Co.,				
Leavenworth, Kan.	9	722	12.94	*15.19*
Pure Wheat Bran.	5	925	14.50	*15.19*
	9	1029	15.06	*15.19*
	7	1274	15.00	*15.19*
	7	1396	13.94	*15.19*
	3	1597	14.75	*15.19*
	4	1785	14.53	*15.19*
	1	2075	15.19	*15.19*
	3	2125	15.44	*15.19*
Average	48		14.59	*15.19*
Lexington Flouring Mills,				
Lexington, Mo.	2	767	15 50	*13.57*
Bran.	1	1695	15.31	*13.57*
Average	3		15.41	*13.57*
Lukens Milling Co.,				
Atchison, Kan.	3	1201	14.50	*11.00*
Wheat Bran.	1	1862	13.69	*11.00*
Average	4		14.10	*11.00*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.19	*3.58*	52.84	*54.60*	9.34	*10.00*	10.91	6.16
4.72	*3.58*	53.65	*54.60*	8.57	*10.00*	12.52	5.66
4.60	*3.58*	52.47	*54.60*	8.85	*10.00*	11.65	5.99
4.64	*3.58*	53.78	*54.60*	8.93	*10.00*	9.23	6.42
4.20	*3.58*	53.08	*54.60*	9.27	*10.00*	11.12	5.91
4.16	*3.58*	52.45	*54.60*	9.40	*10.00*	11.35	6.51
3.88	*3.58*	52.63	*54.60*	10.19	*10.00*	11.97	6.46
3.95	*3.58*	54.71	*54.60*	9.68	*10.00*	10.28	6.52
4.37	*3.58*	52.81	*54.60*	10.69	*10.00*	9.93	6.48
4.23	*3.58*	51.45	*54.60*	9.32	*10.00*	12.96	6.23
4.21	*3.58*	55.50	*54.60*	8.92	*10.00*	10.70	6.05
4.20	*3.58*	52.23	*54.60*	10.42	*10.00*	12.00	6.52
4.50	*3.58*	52.24	*54.60*	9.94	*10.00*	10.37	6.14
4.30	*3.58*	53.07	*54.60*	9.50	*10.00*	11.15	6.23
4.32	*3.58*	57.91	*54.00*	7.46	*10.00*	11.28	5.65
3.70	*3.58*	55.73	*54.00*	9.07	*10.00*	10.98	6.39
4.01	*3.58*	56.82	*54.00*	8.26	*10.00*	11.13	6.02
3.98	*3.85*	55.75	*52.85*	10.12	*9.15*	10.62	6.59
4.16	*3.85*	54.66	*52.85*	9.33	*9.15*	11.27	6.08
4.45	*3.85*	56.07	*52.85*	8.63	*9.15*	10.00	5.79
4.35	*3.85*	56.48	*52.85*	8.16	*9.15*	10.46	5.55
4.17	*3.85*	54.74	*52.85*	9.99	*9.15*	10.62	6.54
3.97	*3.85*	54.44	*52.85*	9.50	*9.15*	10.47	6.87
4.32	*3.85*	56.15	*52.85*	9.08	*9.15*	9.84	6.08
4.27	*3.85*	53.08	*52.85*	10.36	*9.15*	10.75	6.35
4.32	*3.85*	53.48	*52.85*	9.71	*9.15*	10.53	6.52
4.22	*3.85*	54.99	*52.85*	9.43	*9.15*	10.51	6.26
4.64	*3.47*	53.75	*51.95*	9.48	*11.48*	9.31	7.32
3.85	*3.47*	58.18	*51.95*	7.14	*11.48*	10.68	4.84
4.25	*3.47*	55.96	*51.95*	8.31	*11.48*	9.99	6.08
4.34	*3.50*	53.88	*50.00*	9.80	*12.00*	10.57	6.91
3.47	*3.50*	57.42	*50.00*	9.38	*12.00*	10.20	5.84
3.91	*3.50*	55.65	*50.00*	9.59	*12.00*	10.38	6.37

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
McEwen Grain Co., **Kansas City, Mo.** Wheat Bran.	1	1080	16.31	*14.01*
	1	1991	15.03	*14.01*
Average	2		15.67	*14.01*
J. F. Meyers & Son, **Springfield, Mo.** Albatross Bran.	1	801	16.25	*14.75*
	1	1098	15.81	*14.75*
	1	1741	15.81	*14.75*
Average	3		15.96	*14.75*
Model Feed.	1	802	15.00	*14.50*
Missouri & Kansas Grain Co., **Neosho, Mo.** Pure Wheat Bran.	1	817	12.37	*9.00*
	2	1022	13.56	*9.00*
	8	1509	14.81	*9.00*
	3	1161	14.13	*9.00*
	5	1425	15.81	*9.00*
	2	1822	15.00	*9.00*
	3	2018	15.69	*9.00*
Average	24		14.47	*9.00*
Nelson Grain Co., **Kansas City, Mo.** Pure Wheat Bran.	1	2168	15.69	*8.30*
Neosho Milling Co., **Neosho, Mo.** Wheat Bran.	3	1079	15.25	*13.00*
	2	1303	15.56	*13.00*
Average	5		15.41	*13.00*
New Athens Milling Co., **New Athens, Ill.** Pure Wheat Bran.	1	1662	16.50	*14.00*
New Era Milling Co., **Arkansas City, Kan.** Wheat Bran.	1	1603	16.94	*14.82*
	2	1202	16.56	*14.82*
	3	1808	16.00	*14.82*
Average	6		16.50	*14.82*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.28	*6.05*	54.42	*58.01*	8.03	*9.03*	11.09	5.87
4.43	*6.05*	54.25	*58.01*	9.34	*9.03*	11.10	5.85
4.36	*6.05*	54.34	*58.01*	8.68	*9.03*	11.09	5.86
5.13	*3.65*	55.77	*52.00*	8.13	*10.50*	9.32	5.40
4.49	*3.65*	55.52	*52.00*	8.07	*10.50*	11.11	5.00
4.20	*3.65*	57.73	*52.00*	8.03	*10.50*	9.33	4.90
4.61	*3.65*	56.34	*52.00*	8.07	*10.50*	9.92	5.10
4.66	*3.50*	57.85	*54.00*	7.63	*8.50*	9.26	5.60
4.13	*3.00*	56.99	*54.00*	9.13	*10.00*	10.95	6.43
6.95	*3.00*	56.67	*54.00*	8.93	*10.00*	9.48	4.41
5.18	*3.00*	56.27	*54.00*	9.17	*10.00*	9.32	5.25
6.34	*3.00*	56.60	*54.00*	8.18	*10.00*	10.07	4.68
4.44	*3.00*	53.79	*54.00*	8.31	*10.00*	12.03	5.62
4.57	*3.00*	53.01	*54.00*	10.01	*10.00*	10.28	7.13
3.97	*3.00*	53.81	*54.00*	9.00	*10.00*	11.94	5.59
5.09	*3.00*	55.31	*54.00*	8.96	*10.00*	10.58	5.59
4.41	*2.40*	53.37	*60.00*	10.11	*15.40*	10.79	5.63
4.21	*3.30*	56.15	*45.00*	7.56	*10.00*	11.78	5.05
4.50	*3.30*	56.65	*45.00*	8.65	*10.00*	9.25	5.39
4.36	*3.30*	56.40	*45.00*	8.10	*10.00*	10.51	5.22
4.48	*3.20*	55.45	*54.00*	7.76	*7.50*	10.10	5.71
4.58	*9.02*	53.72	*38.04*	9.00	*28.10*	10.18	5.58
4.51	*9.02*	52.75	*38.04*	9.10	*28.10*	11.04	6.04
4.01	*9.02*	54.60	*38.04*	9.80	*28.10*	9.51	6.08
4.37	*9.02*	53.69	*38.04*	9.30	*28.10*	10.24	5.90

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
New Orleans Milling Co., **New Orleans, La.** Bran.	3	1265	15.31	*15.19*
	4	707	15.34	*15.19*
	1	1008	15.75	*15.19*
	1	1983	15.31	*15.19*
Average	9		15.43	*15.19*
Nicholas Scharff & Son Grocer Co., **St. Louis, Mo.** Wheat Bran.	1	1979	15.75	*14.10*
Oklahoma City Mills and Elevator Co., **Oklahoma City, Okla.** Wheat Bran.	1	842	14.69	*16.94*
	1	1009	17.25	*16.94*
Average	2		15.97	*16.94*
Wheat Bran.	1	848	17.75	*14.85*
Thos. Page, **Topeka, Kan.** Wheat Bran.	1	1010	15.50	*14.75*
The Pearl Roller Mills, **Oswego, Kan.** Wheat Bran.	5	962	15.19	*14.69*
	7	1181	14.87	*14.69*
	3	1284	15.38	*14.69*
	4	1399	15.06	*14.69*
	2	1543	13.34	*14.69*
	3	1626	13.87	*14.69*
	4	1789	14.43	*14.69*
Average	26		14.59	*14.69*
Pioneer Flour Mills, **San Antonio, Texas.** Wheat Bran.	1	2174	17.56	*14.50*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Guar-anteed.	% Found	% Found
4.14	*3.22*	55.99	*55.45*	9.01	*9.47*	9.67	5.88
4.30	*3.22*	57.23	*55.45*	7.09	*9.47*	11.09	4.95
4.43	*3.22*	54.46	*55.45*	8.64	*9.47*	10.41	6.31
4.15	*3.22*	54.57	*55.45*	8.70	*9.47*	11.45	5.82
4.25	*3.22*	55.56	*55.45*	8.36	*9.47*	10.66	5.74
4.53	*4.50*	51.34	*52.00*	10.74	*8.90*	11.38	6.26
4.93	*4.50*	54.31	*53.54*	8.58	*8.53*	11.95	5.54
4.62	*4.50*	55.27	*53.54*	6.86	*8.53*	10.58	5.42
4.78	*4.50*	54.79	*53.54*	7.72	*8.53*	11.26	5.48
4.94	*3.58*	51.28	*54.60*	8.50	*10.00*	11.84	5.69
4.48	*3.75*	54.73	*55.41*	8.92	*8.60*	10.21	6.16
3.76	*3.92*	57.00	*56.84*	6.67	*8.30*	12.73	4.65
4.19	*3.92*	60.22	*56.84*	6.39	*8.30*	10.12	4.21
4.22	*3.92*	60.19	*56.84*	6.51	*8.30*	9.54	4.16
3.77	*3.92*	58.76	*56.84*	6.37	*8.30*	11.83	4.21
3.70	*3.92*	63.65	*56.84*	4.93	*8.30*	11.28	3.10
3.70	*3.92*	63.62	*56.84*	5.84	*8.30*	9.19	3.78
3.77	*3.92*	61.51	*56.84*	6.28	*8.30*	10.13	3.88
3.87	*3.92*	60.71	*56.84*	6.14	*8.30*	10.69	4.00
3.98	*3.50*	54.15	*50.00*	7.14	*10.00*	12.18	4.99

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Geo. P. Plant Milling Co., **St. Louis, Mo.** Pure Wheat Bran.	5	718	15.75	*15.43*
	5	911	15.31	*15.43*
	4	1108	15.59	*15.43*
	3	1175	15.19	*15.43*
	3	1283	16.69	*15.43*
	4	1361	14.38	*15.43*
	9	1575	15.44	*15.43*
	3	1806	15.28	*15.43*
	5	1881	15.19	*15.43*
	1	2085	15.69	*15.43*
	4	2101	14.13	*15.43*
Average	46		15.33	*15.43*
Ralston Purina Co., **St. Louis, Mo.** Wheat Bran.	2	1219	15.38	*14.10*
Rea Patterson Milling Co., **Coffeyville, Kan.** Wheat Bran.	2	1316	15.75	*14.52*
Reichert Milling Co., **Freeburg, Ill.** Wheat Bran.	6	729	8.31	*11.05*
	2	989	15.81	*11.05*
	5	1341	15.31	*11.05*
	5	1172	15.25	*11.05*
	5	1270	15.19	*11.05*
	4	1466	13.94	*11.05*
	5	1665	15.75	*11.05*
	2	1827	14.31	*11.05*
	3	1922	16.13	*11.05*
	2	2027	15.56	*11.05*
Average	39		14.56	*11.05*
Saxony Mills, **St. Louis, Mo.** Saxony Wheat Bran.	3	740	15.25	*12.00*
	2	887	13.63	*12.00*
	3	1241	15.75	*12.00*
	2	1724	15.75	*12.00*
	2	1828	16.25	*12.00*
	1	1995	15.88	*12.00*
	2	2116	15.69	*12.00*
Average	15		15.46	*12.00*
Russell Grain Co., **Kansas City, Mo.** Square Deal Bran.	1	1732	14.50	*14.20*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed.	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.24	*3.27*	55.77	*54.63*	8.87	*9.72*	9.23	6.14
4.30	*3.27*	54.37	*54.63*	8.82	*9.72*	11.07	6.13
4.57	*3.27*	54.19	*54.63*	8.72	*9.72*	10.66	6.27
4.39	*3.27*	54.32	*54.63*	9.52	*9.72*	9.94	6.64
4.84	*3.27*	54.35	*54.63*	8.83	*9.72*	9.30	5.99
5.85	*3.27*	53.39	*54.63*	9.10	*9.72*	10.94	6.34
4.24	*3.27*	54.98	*54.63*	9.30	*9.72*	9.70	6.34
4.17	*3.27*	53.98	*54.63*	9.94	*9.72*	10.23	6.40
4.93	*3.27*	52.72	*54.63*	9.25	*9.72*	11.57	6.34
4.26	*3.27*	53.55	*54.63*	9.32	*9.72*	11.02	6.16
3.60	*3.27*	53.70	*54.63*	11.39	*9.72*	11.99	5.19
4.49	*3.27*	54.12	*54.63*	9.37	*9.72*	10.51	6.18
4.85	*4.50*	53.79	*52.00*	9.42	*8.90*	10.24	6.32
4.01	*3.29*	56.54	*55.96*	7.87	*8.50*	10.25	5.58
3.30	*2.00*	63.67	*45.00*	12.07	*15.00*	8.80	5.85
4.55	*2.00*	56.21	*45.00*	7.55	*15.00*	10.19	5.65
4.70	*2.00*	55.26	*45.00*	7.86	*15.00*	11.01	5.86
4.47	*2.00*	56.98	*45.00*	7.83	*15.00*	9.99	5.48
4.73	*2.00*	55.23	*45.00*	8.46	*15.00*	10.57	5.82
4.66	*2.00*	57.10	*45.00*	7.59	*15.00*	11.12	5.59
4.33	*2.00*	56.22	*45.00*	8.11	*15.00*	9.63	5.96
4.83	*2.00*	56.26	*45.00*	8.38	*15.00*	10.22	6.00
4 65	*2.00*	54.87	*45.00*	8.33	*15.00*	10.03	5.99
4.90	*2.00*	54.00	*45.00*	7.67	*15.00*	11.89	5.98
4.51	*2.00*	56.58	*45.00*	8.38	*15.00*	10.35	5.62
5.04	*3.00*	55.63	*52.00*	8.10	*10.00*	9.92	6.06
4.45	*3.00*	58.04	*52.00*	7.51	*10.00*	11.08	5.29
4.77	*3.00*	55.40	*52.00*	8.19	*10.00*	9.92	5.97
4.65	*3.00*	55.28	*52.00*	8.06	*10.00*	10.48	5.78
4.44	*3.00*	55.04	*52.00*	8.59	*10.00*	9.90	5.78
4.15	*3.00*	55.11	*52.00*	8.55	*10.00*	10.88	5.43
4.43	*3.00*	55.43	*52.00*	7.75	*10.00*	11.24	5.46
4.56	*3.00*	55.70	*52.00*	8.11	*10.00*	10.49	5.68
4.41	*4.90*	54.38	*54.80*	9.86	*9.70*	9.90	6.95

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Sauers Milling Co., **Evansville, Ill.** Wheat Bran.	3	986	16.06	14.26
	2	1317	15.38	14.26
	1	1993	15.25	14.26
Average	6		15.56	14.26
Scott County Milling Co., **Sikeston and Oran, Mo.** Wheat Bran.	3	728	14.25	14.15
	2	909	17.00	14.15
	6	1165	15.31	14.15
	4	1262	15.31	14.15
	3	1352	15.50	14.15
	11	1442	15.38	14.15
	8	1572	15.75	14.15
	4	1686	15.13	14.15
	1	1844	17.43	14.15
	1	2072	16.81	14.15
Average	43		15.79	14.15
Security Milling Co., **Abeline, Kan.** Wheat Bran.	1	1393	15.81	14.85
Seneca Mill & Elevator Co., **Seneca, Mo.** Wheat Bran	3	1353	16.13	13.75
Slater Mill & Elevator Co., **Slater, Mo.** Wheat Bran.	2	1326	14.38	14.03
J. Sidney Smith & Son, **Kansas City, Mo.** Wheat Bran.	1	1216	16.56	14.19
Southern Grain Co., **Kansas City, Mo.** Wheat Bran.	2	971	15.38	17.17
	1	799	17.28	17.17
	1	1047	13.56	17.17
	1	1392	13.34	17.17
	1	2086	16.44	17.17
Average	6		15.20	17.17

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.55	*3.21*	53.31	*55.18*	8.38	*8.80*	11.61	6.09
4.50	*3.21*	55.07	*55.18*	8.38	*8.80*	10.51	6.16
4.43	*3.21*	54.22	*55.18*	8.90	*8.80*	11.48	5.72
4.49	*3.21*	54.20	*55.18*	8.56	*8.80*	11.20	5.99
4.57	*4.50*	57.97	*57.00*	7.61	*7.10*	9.73	5.87
4.58	*4.50*	53.36	*57.00*	7.66	*7.10*	11.47	5.93
4.54	*4.50*	56.37	*57.00*	7.02	*7.10*	11.39	5.37
4.52	*4.50*	57.53	*57.00*	6.98	*7.10*	10.03	5.63
4.50	*4.50*	57.78	*57.00*	6.67	*7.10*	10.17	5.38
4.04	*4.50*	58.14	*57.00*	5.89	*7.10*	11.78	4.77
4.16	*4.50*	56.71	*57.00*	7.11	*7.10*	10.78	5.49
4.08	*4.50*	58.74	*57.00*	6.70	*7.10*	10.17	5.18
4.12	*4.50*	56.78	*57.00*	7.87	*7.10*	8.05	5.75
4.70	*4.50*	54.24	*57.00*	7.32	*7.10*	10.85	6.0
4.38	*4.50*	56.76	*57.00*	7.08	*7.10*	10.44	5.55
3.97	*3.58*	56.43	*54.60*	7.32	*10.00*	11.86	4.61
4.24	*2.80*	55.08	*49.90*	9.04	*16.25*	9.68	5.83
4.52	*3.61*	54.16	*51.68*	10.18	*9.28*	9.45	7.31
4.56	*3.92*	54.29	*60.56*	8.50	*8.50*	10.41	5.68
4 24	*5.09*	52.63	*50.09*	9.95	*10.04*	10.89	6.91
4.44	*5.09*	52.09	*50.09*	9.79	*10.04*	9.70	6.70
4.20	*5.09*	55.38	*50.09*	10.02	*10.04*	10.31	6.53
3.90	*5.09*	54.02	*50.09*	10.62	*10.04*	11.86	6.26
3.68	*5.09*	54.04	*50.09*	9.32	*10.04*	10.34	6.18
4.09	*5.09*	53.63	*50.09*	9.94	*10.04*	10.62	6.52

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Southwestern Milling Co., Kansas City, Mo. Wheat Bran.	1	798	13.56	*14.85*
	2	1820	14.81	*14.85*
	1	1951	14.38	*14.85*
	1	2081	14.06	*14.85*
Average	5		14.20	*14.85*
Stanard Tilton Milling Co., Dallas, Texas. Bran.	8	747	15.66	*18.64*
	4	958	17.00	*18.64*
	4	1140	16.81	*18.64*
	1	1535	16.91	*18.64*
	4	1786	16.93	*18.64*
	4	1920	16.63	*18.64*
	2	2029	16.94	*18.64*
	1	2171	17.31	*18.64*
Average	28		16.78	*18.64*
St. Mary's Mills Co., St. Mary's, Mo. Soft Winter Wheat Bran.	9	681	15.88	*15.06*
	8	821	13.94	*15.06*
	11	915	13.88	*15.06*
	12	1109	16.38	*15.06*
	8	1272	16.38	*15.06*
	12	1398	16.25	*15.06*
	4	1496	16.00	*15.06*
	6	1574	16.06	*15.06*
	4	1679	16.00	*15.06*
	7	1771	16.31	*15.06*
	4	1899	16.31	*15.06*
	3	2028	16.88	*15.06*
	7	2127	17.63	*15.06*
	1	2170	17.69	*15.06*
Average	96		16.11	*15.06*
Texas Star Flour Mills, Galveston, Texas. Wheat Bran.	5	1489	15.37	*15.37*
	2	1829	17.63	*15.37*
	2	1939	17.81	*15.37*
	1	2077	17.37	*15.37*
	3	2120	17.00	*15.37*
Average	13		17.04	*15.37*
Vanderslice-Lynds Co., Kansas City, Mo. Wheat Bran.	1	895	16.00	*14.85*
	3	1156	15.88	*14.85*
Average			15.94	*14.85*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.25	*3.58*	57.04	*54.60*	9.44	*10.00*	9.79	5.92
4.46	*3.58*	54.12	*54.60*	9.38	*10.00*	10.50	6.73
3.80	*3.58*	54.31	*54.60*	9.75	*10.00*	11.38	6.38
4.07	*3 58*	55.00	*54.60*	9.63	*10.00*	10.35	6.89
4.1	*3.58*	55.12	*54.60*	9.55	*10.00*	10.50	6.48
4.73	*5.20*	57.38	*54.15*	7.68	*9.08*	9.42	5.13
4.64	*5.20*	54.06	*54.15*	7.52	*9.08*	11.65	5.13
4.79	*5.20*	54.25	*54.15*	7.73	*9.08*	11.03	5.39
4.77	*5.20*	54.57	*54.15*	7.75	*9.08*	11.28	5.44
3.91	*5.20*	55.09	*54.15*	7.88	*9.08*	10.74	5.45
4.43	*5.20*	53.93	*54.15*	8.11	*9.08*	11.35	5.55
4.68	*5.20*	54.69	*54.15*	8.02	*9.08*	10.34	5.33
4.74	*5.20*	53.65	*54.15*	8.07	*9.08*	10.84	5.39
4.59	*5.20*	54 70	*54.15*	7.85	*9.08*	10.83	5. 5
5.08	*3.06*	55 02	*54.70*	7.77	*8.93*	10.38	5.87
4.55	*3.06*	55.28	*54.70*	8.38	*8.93*	11.92	5.93
4.73	*3.06*	56.45	*54.70*	8.35	*8.93*	10.33	6.26
4.41	*3.06*	54.26	*54.70*	8.12	*8.93*	10.87	5.96
4.70	*3.06*	54.20	*54.70*	8.25	*8.93*	10.65	5.82
4.69	*3.06*	54.57	*54.70*	7.64	*8.93*	11.20	5.65
4.67	*3.06*	56.82	*54.70*	7.58	*8.93*	9.52	5.41
4.44	*3.06*	56.46	*54.70*	7.32	*8.93*	10.16	5.56
4.57	*3.06*	55.92	*54.70*	7.98	*8.93*	9.86	5.67
4.62	*3.06*	55.36	*54.70*	8.07	*8.93*	9.61	6.03
4.60	*3.06*	56.02	*54.70*	7.80	*8.93*	9.78	5.49
4.64	*3.06*	53.15	*54.70*	8.04	*8.93*	11.27	6.02
4.79	*3.06*	53.05	*54.70*	7.67	*8.93*	10.61	6 25
5.00	*3.06*	52.11	*54.70*	7.89	*8.93*	10.90	6.41
4.68	*3.06*	54.91	*54.70*	7.92	*8.93*	10.50	5.88
3.89	*4.20*	54.88	*54.16*	8.59	*8.45*	11.46	5.81
4.09	*4.20*	54.89	*54.16*	7.70	*8.45*	10.36	5.33
3.83	*4.20*	53.57	*54.16*	9.10	*8.45*	10.25	5.44
3.94	*4.20*	55.53	*54.16*	7.85	*8.45*	10.20	5.10
3.98	*4.20*	54.97	*54.16*	7.68	*8.45*	11.23	5.14
3.95	*4.20*	54.77	*54 16*	8.18	*8.45*	10.70	5.36
4.47	*3.58*	49.67	*54.60*	11.28	*10.00*	10.94	7.64
4.38	*3.58*	49.97	*54.60*	10.95	*10.00*	11.61	7.21
4.42	*3.58*	49.82	*54.60*	11.11	*10.00*	11.27	7.

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guar-anteed
Washington Flour Mills, **Washington, Mo.** Bran.	1	1065	16.88	*14.80*
Western Star Milling Co., **Salina, Kan.** Bran.	6	712	17.50	*14.85*
	1	903	15.13	*14.85*
Average	7		16.32	*14.85*
Wheat Bran.	1	2172	17.50	*12.50*
Wheat Bran.	2	893	15.06	*14.85*
	4	2022	15.63	*14.85*
	3	2123	16.75	*14.85*
Average	9		15.81	*14.85*
Wheat Bran.	3	937	16.75	*12.50*
	2	1648	15.88	*12.50*
	1	1976	15.63	*12.50*
Average	6		16.09	*12.50*
Yates & Donelson Co., **Memphis, Tenn.** Pure Wheat Bran.	1	815	15.44	*14.85*
	2	1663	11.69	*14.85*
Average	3		13.57	*14.85*
Mixed Bran.	1	1990	13.69	*13.25*
Zenith Milling Co., **Kansas City, Mo.** Bran in Unbranded Sacks Marked "B."	5	727	15.38	*14.05*
	3	1160	14.00	*14.05*
	4	1271	15.63	*14.05*
	3	1493	15.19	*14.05*
	4	1569	14.25	*14.05*
	1	1997	15.13	*14.05*
	1	2176	16.06	*14.05*
Average	21		15.09	*14.05*
Wheat Bran.	1	1377	13.56	*16.00*

BRAN.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.43	*3.97*	52.56	*52.83*	8.84	*9.00*	11.37	5.92
4.79	*3.58*	54.05	*45.60*	7.50	*10.00*	10.86	5.30
4.43	*3.58*	55.15	*45.60*	9.13	*10.00*	10.28	5.88
4.61	*3.58*	54.60	*45.60*	8.31	*10.00*	10.57	5.59
4.33	*2.75*	51.21	*51.60*	9.30	*12.00*	11.17	6.49
4.45	*3.58*	52.11	*54.60*	9.20	*10.00*	12.49	6.69
4.20	*3.58*	53.80	*54.60*	9.43	*10.00*	11.08	5.86
4.00	*3.58*	52.14	*54.60*	9.30	*10.00*	11.49	6.32
4.22	*3.58*	52.68	*54.60*	9.31	*10.00*	11.69	6.29
3.91	*2.75*	52.91	*51.60*	9.76	*12.00*	10.78	5.89
4.10	*2.75*	54.79	*51.60*	9.76	*12.00*	9.54	5.93
4.25	*2.75*	52.94	*51.60*	10.38	*12.00*	11.18	5.62
4.09	*2.75*	53.55	*51.60*	9.96	*12.00*	10.50	5.81
4.08	*3.58*	57.16	*54.60*	6.69	*10.00*	11.47	5.16
4.06	*3.58*	62.75	*54.60*	7.49	*10.00*	9.90	4.11
4.07	*3.58*	59.96	*54.60*	7.09	*10.00*	10.68	4.63
4.43	*3.70*	58.77	*57.15*	7.95	*10.00*	10.70	4.46
4.32	*5.05*	53.96	*50.04*	9.69	*13.05*	10.33	6.32
4.65	*5.05*	54.92	*50.04*	9.02	*13.05*	11.69	5.72
4.57	*5.05*	53.87	*50.04*	8.99	*13.05*	11.16	5.78
4.67	*5.05*	55.46	*50.04*	8.67	*13.05*	10.40	5.61
4.56	*5.05*	56.51	*50.04*	9.03	*13.05*	9.72	5.93
5.08	*5.05*	53.78	*50.04*	8.63	*13.05*	11.75	5.63
4.16	*5.05*	51.98	*50.04*	9.88	*13.05*	11.85	6.07
4.57	*5.05*	54.35	*50.04*	9.13	*13.05*	10.99	5.87
3.90	*7.10*	54.57	*32.33*	9.85	*9.00*	11.61	6.51

WHEAT

Name of Manufacturer or Jobber and Brand.	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Atchison Live Stock Co., **Atchison, Kan.** Triumph White Shorts.	1	792	14.22	*12.00*
Atchison Live Stock Co., **Atchison, Kan.** Wheat Shorts.	14	692	16.25	*10.50*
	1	877	13.19	*10.50*
	2	1205	15.75	*10.50*
	3	1921	15 75	*10.50*
	3	2033	17 28	*10.50*
Average	23		15.64	*10.50*
Aurora Milling Co., **Aurora, Mo.** Cream Wheat Shorts.	16	979	15.44	*15.00*
	2	1285	14.25	*15.00*
Average	18		14.85	*15.00*
The Blair Milling Co., **Atchison, Kan.** Blair's Shorts.	2	894	15.06	*16.75*
	3	1292	15.81	*16.75*
	1	1754	16.87	*16.75*
	3	731	17.06	*16.75*
	2	1872	13.88	*16.75*
	1	2177	16.00	*16.75*
Average	12		15.78	*16.75*
The Cain Mill Co., **Atchison, Kan.** Cain's Shorts.	2	1085	15.13	*15.43*
	1	1861	17.13	*15.43*
	1	2059	15.75	*15.43*
	3	2142	17.37	*15.43*
Average	7		16.34	*15.43*
Chopman Milling Co., **Sherman, Texas.** Stock Feed or Shorts.	1	789	15.28	*16.75*

PRODUCTS.

Fat		Carbohydrates		Fiber		Water	Ash
Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.24	*4.50*	55.58	*42.00*	10.24	*19.00*	9.27	6.45
5.80	*1.50*	56.97	*41.00*	6.29	*19.50*	10.35	4.34
6.13	*1.50*	56.54	*41.00*	7.48	*19.50*	12.05	4.61
5.31	*1.50*	57.64	*41.00*	6.66	*19.50*	9.95	4.69
4.18	*1.50*	61.91	*41.00*	4.08	*19.50*	10.85	3.23
4.41	*1.50*	59.69	*41.00*	4.10	*19.50*	11.06	3.46
5.16	*1.50*	58.55	*41.00*	5.73	*19.50*	10.85	4.07
4.88	*3.60*	61.43	*60.00*	4.32	*4.90*	10.90	3.03
2.08	*3.60*	71.19	*60.00*	1.05	*4.90*	10.45	0.98
3.48	*3.60*	66.31	*60.00*	2.69	*4.90*	10.67	2.00
5.79	*3.50*	55.31	*58.95*	6.86	*8.98*	12.41	4.57
5.36	*3.50*	60.53	*58.95*	4.92	*8.98*	9.75	3.63
4.21	*3.50*	58.24	*58.95*	6.30	*8.98*	10.23	4.15
4.84	*3.50*	58.98	*58.95*	5.69	*8.98*	9.04	4.39
5.20	*3.50*	62.10	*58.95*	5.33	*8.98*	9.40	4.09
4.12	*3.50*	60.59	*58.95*	4.96	*8.98*	10.72	3.61
4.92	*3.50*	59.29	*58.95*	5.68	*8.98*	10.26	4.07
4.41	*4.91*	59.41	*59.19*	5.55	*3.22*	11.14	4.36
4.75	*4.91*	57.05	*59.19*	6.05	*3.22*	10.75	4.27
4.73	*4.91*	59.05	*59.19*	5.21	*3.22*	11.48	3.78
4.84	*4.91*	58.02	*59.19*	5.09	*3.22*	10.77	3.91
4.68	*4.91*	58.38	*59.19*	5.48	*3.22*	11.04	4.08
4.76	*5.25*	58.80	*56.14*	6.38	*6.30*	10.23	4.55

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
The Davis Milling Co., **St. Joseph, Mo.** Pure Wheat Shorts or Middlings.	1	791	14.01	*13.00*
	2	1187	15.31	*13.00*
	3	1446	13.63	*13.00*
	1	1756	15.65	*13.00*
	2	1925	16.50	*13.00*
	1	2057	15.25	*13.00*
	1	2181	16.56	*13.00*
Average	11		15.27	*13.00*
Diamond Milling Co., **Sherman, Texas.** Wheat Shorts.	4	732	19.19	*17.00*
	1	1412	17.00	*17.00*
Average	5		18.09	*17.00*
Enid Mill & Elevator Co., **Enid, Okla.** Wheat Shorts.	1	1482	13.06	*18.00*
Hunter Bros. Milling Co., **St. Louis, Mo.** Pure Wheat Shorts or Middlings.	1	1863	17.09	*16.00*
Kelly-Lysle Milling Co., **Leavenworth, Kan.** Pure Wheat Shorts.	1	659	17.78	*14.09*
	4	828	14.81	*14.09*
	7	914	16.13	*14.09*
	3	1308	16.94	*14.09*
	2	1491	13.09	*14.09*
	2	1655	16.00	*14.09*
	5	1888	16.69	*14.09*
Average	24		15.92	*14.09*
The Leavenworth Milling Co., **Leavenworth, Kan.** Pure Wheat Shorts.	7	702	15.13	*14.04*
	6	953	15.81	*14.04*
	3	1178	15.94	*14.04*
	3	1325	15.69	*14.04*
	4	1654	16.91	*14.04*
	1	1981	15.94	*14.04*
	3	2034	16.13	*14.04*
	1	2178	16.25	*14.04*
Average	28		15.98	*14.04*

PRODUCTS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.71	*4.50*	61.08	*55.00*	5.45	*5.00*	10.80	3.95
4.85	*4.50*	60.72	*55.00*	5.16	*5.00*	9.76	4.20
3.67	*4.50*	57.12	*55.00*	8.18	*5.00*	11.71	5.69
5.01	*4.50*	60.61	*55.00*	4.64	*5.00*	10.26	3.83
3.75	*4.50*	62.11	*55.00*	2.55	*5.00*	10.43	4.66
5.95	*4.50*	58.50	*55.00*	5.14	*5.00*	11.24	3.92
4.27	*4.50*	59.87	*55.00*	5.13	*5.00*	10.43	3.74
4.58	*4.50*	60.03	*55.00*	5.18	*5.00*	10.66	4.28
5.03	*6.00*	58.33	*55.80*	4.33	*4.74*	9.42	3.70
5.16	*6.00*	55.05	*55.80*	5.80	*4.74*	12.26	4.73
5.10	*6.00*	56.69	*55.80*	5.06	*4.74*	10.84	4.22
1.52	*5.00*	72.54	*54.80*	0.72	*6.40*	11.34	0.82
4.45	*4.00*	58.97	*56.00*	5.00	*10.00*	10.70	3.79
4.12	*4.50*	57.12	*56 08*	5.68	*7.04*	10.19	5.11
5.93	*4.50*	53.94	*56 08*	6.87	*7.04*	11.00	4.45
5.15	*4.50*	56.88	*56.08*	5.67	*7.04*	11.72	4.45
5.49	*4.50*	59.03	*56.08*	5.64	*7.04*	8.51	4.39
4.91	*4.50*	58.72	*56.08*	7.58	*7.04*	10.68	5.02
5.03	*4.50*	60.71	*56.08*	5.76	*7.04*	8.54	3.96
5.25	*4.50*	54.21	*56.08*	7.52	*7.04*	11.60	4.73
5.12	*4.50*	57.66	*56.08*	6.39	*7.04*	10.32	4.59
5.13	*4.60*	59.66	*56.04*	5.06	*7.04*	11.10	3.92
4.64	*4.60*	58.35	*56.04*	5.15	*7.04*	12.35	3.70
4.71	*4.60*	59.95	*56.04*	5.05	*7.04*	10.27	4.08
4.63	*4.60*	59.71	*56.04*	5.45	*7.04*	10.49	4.03
4.87	*4.60*	58.60	*56.04*	5.83	*7.04*	9.68	4.11
4.45	*4.60*	58.08	*56.04*	6.48	*7.04*	11.08	3.97
4.33	*4.60*	58.12	*56.04*	5.98	*7.04*	11.20	4.24
4.82	*4.60*	57.95	*56.04*	6.18	*7.04*	10.44	4.36
4.69	*4.60*	58.80	*56.04*	5.65	*7.04*	10.83	4.05

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Lexington Flouring Mill, **Lexington, Mo.** Shorts.	2	761	16.50	*16.55*
	1	1738	17.30	*16.55*
Average	3		16.90	*16.55*
S. C. Le Mar, **Rich Hill, Mo.** Wheat Shorts.	1	1069	14.94	*15.12*
Lukens Milling Co., **Atchison, Kan.** Wheat Shorts.	5	1136	16.44	*13.00*
	1	1859	16.00	*13.00*
Average	6		16.22	*13.00*
McEwen Grain Co., **Kansas City, Mo.** Wheat Shorts.	3	1910	18.06	*14.00*
Neosho Milling Co., **Neosho, Mo.** Wheat Shorts.	1	1063	16.94	*15.00*
	3	1492	15.06	*15.00*
	1	1753	16.87	*15.00*
	1	1980	17.88	*15.00*
Average	6		16.68	*15.00*
New Orleans Milling Co., **New Orleans, La.** Middlings.	3	751	15.50	*15.09*
	1	1007	15.56	*15.09*
	2	1327	15.56	*15.09*
	1	1961	14.69	*15.09*
Average	7		15.33	*15.09*
Geo. P. Plant Milling Co., **St. Louis, Mo.** P. Middlings.	1	803	15.44	*17.11*
Plant Milling Co., **St. Louis, Mo.** Wheat Shorts.	1	1480	17.25	*17.11*
The Rea-Patterson Milling Co., **Coffeyville, Kan.** Wheat Shorts.	2	1481	17.13	*15.22*

PRODUCTS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
6.12	*5.77*	57.05	*58.01*	4.85	*4.33*	10.97	4.51
4.12	*5.77*	53.35	*58.01*	9.35	*4.33*	9.83	6.05
5.12	*5.77*	55.20	*58.01*	7.10	*4.33*	10.40	5.28
4.31	*4.08*	60.65	*63.65*	4.60	*3.75*	11.62	3.88
5.21	*4.00*	56.67	*55.00*	5.90	*9.00*	11.19	4.59
4.23	*4.00*	56.75	*55.00*	7.10	*9.00*	10.85	5.07
4.72	*4.00*	56.71	*55.00*	6.50	*9.00*	11.02	4.83
5.25	*5.05*	56.37	*64.00*	4.53	*5.00*	11.60	4.19
5.21	*3.50*	57.23	*52.00*	5.97	*8.00*	10.60	4.05
4.63	*3.50*	60.74	*52.00*	4.96	*8.00*	11.33	3.28
4.73	*3.50*	58.28	*52.00*	6.20	*8.00*	10.19	3.73
3.65	*3.50*	56.17	*52.00*	7.89	*8.00*	11.20	3.21
4.56	*3.50*	58.11	*52.00*	6.26	*8.00*	10.83	3.56
4.36	*4.12*	57.40	*64.05*	6.84	*3.42*	11.13	4.77
4.11	*4.12*	60.83	*64.05*	4.50	*3.42*	11.12	3.88
4.03	*4.12*	63.58	*64.05*	4.05	*3.42*	9.91	2.87
3.70	*4.12*	65.25	*64.05*	3.85	*3.42*	9.80	2.71
4.05	*4.12*	61.76	*64.05*	4.81	*3.42*	10.49	3.56
4.97	*4.41*	62.09	*59.11*	5.03	*5.18*	8.58	3.89
4.65	*4.41*	57.02	*59.18*	5.65	*5.18*	11.18	4.25
4.59	*3.94*	57.76	*61.02*	5.62	*4.25*	11.18	3.72

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Scott County Milling Co., **Sikeston and Oran, Mo.** Middlings	2	1394	15.88	*16.27*
	1	1860	15.94	*16.27*
Average	3		15.91	*16.27*
Slater Milling Co., **Slater, Mo.** Wheat Shorts.	2	1309	16.38	*15.36*
Southwestern Milling Co., **Kansas City, Mo.**	2	891	16.06	*14.90*
Wheat Shorts.	2	1312	17.63	*15.50*
	3	1456	15.56	*15.50*
K. C. K. Shorts.	1	2180	16.44	*15.50*
Average	6		16.55	*15.50*
Stanard Tilton Milling Co., **Dallas, Tex.** Wheat Shorts.	1	1752	17.93	*20.19*
	1	1953	16.44	*20.19*
	1	2060	18.00	*20.19*
	1	2179	17.31	*20.19*
Average	4		17.42	*20.19*
I. M. Yost Milling Co., **Hayes City, Kan.** **Wheat Shorts.**	1	1064	18.06	*14.90*
	1	1739	18.62	*14.90*
Average	2		18.34	*14.90*
Carbondale Manufacturing Co., **Carbondale, Ill.** Shipstuf	2	1926	16.06	*16.20*
Charleston Milling Co., **Charleston, Mo.** Shipstuff	1	830	14.87	*14.35*
City Grain & Feed Co., **Columbia, Tenn.** Star Mixed Feed.	5	1256	10.25	*11.53*
	1	663	8.44	*11.53*
	1	1978	9.94	*11.53*
Average	7		9.54	*11.53*

PRODUCTS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.53	*5.90*	61.61	*61.60*	4.21	*3.45*	10.31	3.46
3.63	*5.90*	64.94	*61.60*	2.63	*3.45*	10.45	2.41
4.08	*5.90*	63.28	*61.60*	3.42	*3.45*	10.38	2.93
1.42	*4.55*	63.46	*56.39*	3.89	*5.28*	9.09	2.76
5.16	*4.50*	53.71	*56.80*	7.57	*7.40*	12.82	4.68
5.17	*5.25*	54.20	*61.25*	8.60	*6.25*	9.32	5.08
4.31	*5.25*	55.64	*61.25*	7.06	*6.25*	12.34	5.09
5.29	*5.25*	57.50	*61.25*	5.26	*6.25*	11.13	4.38
4.90	*5.25*	55.79	*61.25*	6.98	*6.25*	10.93	4.85
3.05	*4.20*	63.53	*56.25*	2.83	*7.40*	9.98	2.68
2.98	*4.20*	64.99	*56.25*	2.53	*7.40*	10.80	2.26
2.78	*4.20*	63.25	*56.25*	2.28	*7.40*	11.70	1.99
4.05	*4.20*	62.37	*56.25*	2.78	*7.40*	10.88	2.61
3.22	*4.20*	63.53	*56.25*	2.61	*7.40*	10.84	2.38
3.56	*4.50*	59.99	*56.80*	4.25	*7.40*	10.85	3.29
4.20	*4.50*	58.56	*56.80*	4.95	*7.40*	9.79	3.88
3.88	*4.50*	59.27	*56.80*	4.60	*7.40*	10.32	3.59
4.18	*3.90*	56.89	*60.30*	6.93	*4.15*	11.05	4.89
4.78	*5.20*	61.23	*60.20*	3.94	*4.50*	11.70	3.48
2.76	*2.63*	55.71	*53.97*	17.47	*15.45*	9.70	4.09
3.24	*2.63*	63.71	*53.97*	10.86	*15.45*	9.73	4.02
2.28	*2.63*	50.60	*53.97*	22.25	*15.45*	10.38	4.55
2.76	*2.63*	56.68	*53.97*	16.86	*15.45*	6.94	4.22

WHEAT

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Cuningham Com. Co., **Little Rock, Ark.** Mixed Mill Feed.	8	1111	13.88	*13.08*
	16	983	14.50	*13.08*
	12	1185	14.08	*13.08*
	14	1275	13.50	*13.08*
	9	1336	15.31	*13.08*
	3	1455	13.71	*13.08*
	7	1568	15.56	*13.08*
	2	1707	15.46	*13.08*
	2	1854	14.31	*13.08*
	5	1887	13.69	*13.08*
Average	78		14.40	*13.08*
Lev. Fowler, **Shreveport, La.** Mixed Bran.	4	999	14.25	*10.97*
Higginsville Milling Co., **Higginsville, Mo.** Shipstuff or Shorts.	3	1402	12.13	*18.30*
	2	1933	16.50	*18.30*
	1	2058	16.38	*18.30*
Average	6		15.00	*18.30*
Illinois Central Elevators, **New Orleans, La.** Elevator Screenings.	1	882	9.94	*2.00*
Kelly-Lysle Milling Co., **Leavenworth, Kan.** Pure Wheat Shorts.	3	2143	17.00	*14.09*
Henry A. Klyce & Co., **Dyersburg, Tenn.** Furfur Spica.	2	670	10.91	*10.27*
The Rea-Patterson Milling Co., **Coffeyville, Kan.** Mixed Feed.	4	713	9.38	*14.30*
Sauers Milling Co., **Evansville, Ind.** Wheat Shipstuff.	1	1071	16.63	*14.96*
	1	1378	16.00	*14.96*
	1	1992	15.63	*14.96*
Average	3		16.09	*14.96*

PRODUCTS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Found
5.27	*4.05*	51.96	*52.00*	12.24	*11.00*	8.76	7.89
4.81	*4.05*	52.45	*52.00*	10.75	*11.00*	10.40	7.09
5.07	*4.05*	51.59	*52.00*	12.06	*11.00*	9.44	7.76
5.02	*4.05*	52.55	*52.00*	11.65	*11.00*	9.91	7.37
4.92	*4.05*	55.42	*52.00*	7.92	*11.00*	11.06	5.37
4.66	*4.05*	50.31	*52.00*	11.92	*11.00*	11.81	7.59
5.19	*4.05*	59.04	*52.00*	5.98	*11.00*	9.48	4.75
4.58	*4.05*	54.56	*52.00*	9.10	*11.00*	10.40	5.90
4.46	*4.05*	56.53	*52.00*	10.12	*11.00*	7.75	6.83
3.40	*4.05*	54.66	*52.00*	9.23	*11.00*	11.15	7.87
4.74	*4.05*	53.91	*52.00*	10.10	*11.00*	10.01	6.84
7.09	*5.72*	51.00	*48.41*	11.00	*16.86*	9.51	7.15
5.68	*4.87*	60.36	*59.68*	5.91	*4.50*	11.63	4.29
4.50	*4.87*	58.95	*59.68*	5.75	*4.50*	10.00	4.30
3.73	*4.87*	60.12	*59.68*	4.92	*4.50*	11.22	3.63
4.64	*4.87*	59.81	*59.68*	5.53	*4.50*	10.95	4.07
2.28	*2.00*	63.25	*50.00*	7.50	*30.00*	11.44	5.59
4.69	*4.50*	58.55	*56.08*	5.35	*7.04*	10.45	3.96
2.84	*2.35*	57.02	*50.86*	14.16	*20.62*	10.66	4.41
4.36	*3.50*	59.86	*57.33*	11.87	*7.90*	10.68	3.85
5.19	*4.20*	59.13	*60.10*	5.09	*4.92*	9.91	4.05
5.18	*4.20*	59.67	*60.10*	5.05	*4.92*	9.93	4.17
4.30	*4.20*	58.29	*60.10*	6.31	*4.92*	11.15	4.32
4.89	*4.20*	59.03	*60.10*	5.48	*4.92*	10.33	4.18

WHEAT

Name of Manufacturer Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed.
A. Waller & Co.,	1	1067	10.75	*11.50*
Henderson, Ky.	1	1485	10.75	*11.50*
Blue Grass Mixed Feed.				
Average	2		10.75	*11.50*
Washington Flour Mill Co.,				
Washington, Mo.	1	1066	16.94	*16.95*
Shipstuff or Shorts.				
Yates & Donelson Co.,	11	680	14.25	*13.25*
Memphis, Tenn.	4	885	13.19	*13.25*
Mixed Bran.	9	1147	14.00	*13.25*
	3	1328	14.44	*13.25*
Average	27		13.97	*13.25*

MOLASSES

Name of Manufacturer Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed.
Alfalfa Product Co.,				
Fremont, Neb.	1	795	15.25	*14.00*
Alfalfa Lass.	1	1476	11.69	*14.00*
Alfalfa and Molasses.				
Average.	2		13.47	*14.00*
American Milling Co.,	5	667	16.56	*16.50*
Owensboro, Ky.	4	778	18.28	*16.50*
Sucrene Dairy Feed.	4	964	15.13	*16.50*
	2	1277	19.09	*16.50*
	4	1473	17.06	*16.50*
	3	1907	16.63	*16.50*
	3	1643	18.25	*16.50*
	1	2044	17.25	*16.50*
	2	2138	17.69	*16.50*
Average	28		17.31	*16.50*
Sucrene Horse Feed.	3	671	14.66	*13.50*
Sucrene Horse, Mule and Ox Feed.	6	959	10.75	*10.00*
	3	1451	12.25	*10.00*
	3	1600	13.06	*10.00*
	3	1900	12.50	*10.00*
	3	2024	12.86	*10.00*
	2	2118	12.06	*10.00*
Average	20		12.25	*10.00*

PRODUCTS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
2.77	*3.19*	55.53	*55.00*	17.65	*15.64*	9.72	3.58
2.70	*3.19*	54.71	*55.00*	17.01	*15.64*	11.02	3.81
2.74	*3.19*	55.12	*55.00*	17.33	*15.64*	10.37	3.69
4.50	*5.48*	61.69	*58.14*	3.46	*3.97*	10.41	3.00
4.75	*3.70*	57.90	*57.15*	8.05	*10.00*	10.58	4.47
4.31	*3.70*	58.57	*57.15*	7.72	*10.00*	11.75	4.46
4.87	*3.70*	59.23	*57.15*	7.36	*10.00*	10.36	4.18
4.42	*3.70*	58.61	*57.15*	7.86	*10.00*	10.16	4.51
4.59	*3.70*	58.58	*57.15*	7.75	*10.00*	10.71	4.40

FEEDS.

1.16	*2.00*	42.82	*44.00*	20.86	*20.00*	11.21	8.70
0.54	*2.00*	43.33	*44.00*	19.23	*20.00*	16.41	*8.80
0.85	*2.00*	43.08	*44.00*	20.04	*20.00*	13.81	8.71
3.76	*3.50*	47.53	*48.27*	10.26	*12.40*	13.21	8.68
5.20	*3.50*	42.46	*48.27*	11.05	*12.40*	15.34	7.67
4.71	*3.50*	46.07	*48.27*	12.50	*12.40*	13.41	8.18
7.02	*3.50*	44.96	*48.27*	11.68	*12.40*	8.69	8.56
4.52	*3.50*	46.31	*48.27*	11.61	*12.40*	12.64	7.86
5.25	*3.50*	46.03	*48.27*	11.95	*12.40*	13.28	6.86
5.36	*3.50*	47.66	*48.27*	12.02	*12.40*	9.37	7.34
5.51	*3.50*	45.27	*48.27*	11.47	*12.40*	13.39	7.11
7.10	*3.50*	44.30	*48.27*	11.66	*12.40*	12.04	7.21
5.38	*3.50*	45.62	*48.27*	11.63	*12.40*	12.37	7.69
2.82	*3.50*	51.08	*56.50*	10.19	*11.50*	13.39	7.86
4.06	*3.00*	52.04	*52.45*	10.97	*13.50*	14.43	7.75
4.75	*3.00*	51.19	*52.45*	10.59	*13.50*	14.21	7.01
4.06	*3.00*	52.48	*52.45*	11.14	*13.50*	12.12	7.14
5.15	*3.00*	52.41	*52.45*	11.15	*13.50*	12.03	6.76
3.59	*3.00*	53.22	*52.45*	10.61	*13.50*	13.00	6.72
3.77	*3.00*	53.68	*52.45*	9.40	*13.50*	14.85	6.24
4.23	*3.00*	52.50	*52.45*	10.64	*13.50*	13.44	6.94

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*This sample was in the laboratory a long time before being analyzed

MOLASSES

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Atlas Feed Products & Milling Co., **New Orleans, La.**	1	776	8.36	*8.00*
Royal Feed.	4	1794	9.68	*8.00*
Ox Feed.	1	1986	11.47	*8.00*
Average	5	673	10.58	*8.00*
Sugar Feed.	1		7.34	*5.00*
	4	705	8.75	*5.00*
	3	878	10.09	*5.00*
	4	1179	6.13	*5.00*
	2	1299	8.94	*5.00*
	5	1513	8.06	*5.00*
	10	1623	10.75	*5.00*
	5	1792	8.18	*5.00*
	5	1882	8.44	*5.00*
	2	2051	9.00	*5.00*
	1	2150	10.44	*5.00*
Average	42		8.74	*5.00*
Union Dairy.	1	1728	7.50	*15.00*
	1	1965	16.29	*15.00*
	1	2061	17.31	*15.00*
Average	3		13.70	*15.00*
Lawrence & Hamilton, **New Orleans, La.** Stafolife Feed.	7	1146	10.84	*11.50*
	5	1257	10.06	*11.50*
	8	1339	10.63	*11.50*
	19	1433	10.50	*11.50*
	6	1515	11.44	*11.50*
	5	1666	11.19	*11.50*
	10	1768	10.68	*11.50*
	15	1874	12.56	*11.50*
	5	2000	13.00	*11.50*
	8	2104	10.75	*11.50*
Average	88		11.17	*11.50*

FEEDS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.92	*1.00*	53.67	*48.00*	8.95	*10.00*	17.15	7.95
2.60	*1.00*	55.13	*48.00*	12.99	*10.0*	11.92	7.68
4.24	*1.00*	53.82	*48.00*	11.15	*10.00*	13.08	6.24
3.42	*1.00*	54.47	*48.00*	12.07	*10.00*	12.50	6.96
1.07	*0.50*	54.59	*50.00*	11.12	*10.00*	15.42	10.46
2.28	*0.50*	52.40	*50.00*	12.64	*10.00*	14.86	9.07
3.75	*0.50*	48.85	*50.00*	13.69	*10.00*	15.30	8.32
1.26	*0.50*	56.53	*50.00*	13.61	*10.00*	13.10	9.37
4.13	*0.50*	56.60	*50.00*	11.69	*10.00*	10.80	7.84
2.02	*0.50*	54.04	*50.00*	12.72	*10.00*	14.84	8.32
3.34	*0.50*	54.64	*50.00*	12.91	*10.00*	10.03	8.33
3.12	*0.50*	51.57	*50.00*	15.34	*10.00*	12.21	9.58
1.75	*0.50*	53.57	*50.00*	14.53	*10.00*	13.45	8.26
2.12	*0.50*	52.09	*50.00*	15.07	*10.00*	13.88	7.85
1.99	*0.50*	48.04	*50.00*	17.56	*10.00*	13.37	8.60
2.44	*0.50*	52.99	*50.00*	13.71	*10.00*	13.39	8.73
8.10	*3.50*	51.77	*45.00*	12.12	*12.00*	11.11	9.40
5.28	*3.50*	42.97	*45.00*	12.60	*12.00*	8.98	13.88
4.62	*3.50*	41.82	*45.00*	13.19	*12.00*	10.20	12.86
6.00	*3.50*	45.52	*45.00*	12.64	*12.00*	10.09	12.05
6.56	*6.50*	50.66	*56.00*	11.73	*10.50*	10.63	9.58
6.08	*6.50*	52.78	*56.00*	12.47	*10.50*	9.56	9.05
6.72	*6.50*	51.29	*56.00*	11.19	*10.50*	11.55	8.62
5.94	*6.50*	52.34	*56.00*	11.06	*10.50*	11.95	8.21
5.97	*6.50*	51.46	*56.00*	11.53	*10.50*	11.51	8.09
5.06	*6.50*	56.85	*56.00*	9.22	*10.50*	10.54	7.14
5.59	*6.50*	54.07	*56.00*	11.56	*10.50*	9.20	8.90
6.58	*6.50*	51.36	*56.00*	9.08	*10.50*	12.65	7.77
5.48	*6.50*	52.45	*56.00*	9.90	*10.50*	11.30	7.87
4.10	*6.50*	52.17	*56.00*	12.43	*10.50*	12.01	8.54
5.81	*6.50*	52.54	*56.00*	1.01	*10.50*	11.09	8.38

MOLASSES

Name of Manufacturer or Jobber and Brand.	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Lawrence Feed Co., **Crowley, La.** Nutriline.	15	654	10.75	*12.37*
Nutriline Feed & Oil Co., **Crowley, La.** Nutriline Dairy Feed. **Corn, Rice Bran, Rice Polish, Cotton Seed Meal and Molasses.**	6	683	16.81	*17.00*
	11	917	15.50	*17.00*
	8	1030	16.38	*17.00*
	6	1233	14.56	*17.00*
	2	1520	22.31	*17.00*
	3	1641	21.88	*17.00*
	2	1825	20.75	*17.00*
Average.	38		18.31	*17.00*
Momylk Horse Feed.	1	1586	14.31	*13.75*
Nutriline Stock Feed. **Corn, Rice Bran, Rice Polish, Cotton Seed Meal and Molasses.**	26	687	13.69	*12.00*
	27	922	13.38	*12.00*
	22	1035	13.81	*12.00*
	14	1236	13.31	*12.00*
	15	1348	14.63	*12.00*
	22	1435	14.31	*12.00*
	16	1500	15.81	*12.00*
	24	1562	14.81	*12.00*
	3	1676	14.44	*12.00*
	8	1767	15.43	*12.00*
	4	1897	16.50	*12.00*
	9	2007	11.63	*12.00*
	6	2109	14.93	*12.00*
Average	196		14.37	*12.00*

CORN

Name of Manufacturer or Jobber and Brand.	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Atchison Live Stock Co., **Atchison, Kan.** Corn Chops.	25	682	9.88	*5.50*
	11	871	9.25	*5.50*
	4	1122	8.50	*5.50*
	1	2037	10.25	*5.50*
	2	2136	9.31	*5.50*
Average	43		9.44	*5.50*
Blair Milling Co., **Atchison, Kan.** Blair's Corn Chops.	2	886	9.69	*10.50*
	3	1287	9.75	*10.50*
Average	5		9.72	*10.50*

FEEDS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Found
3.12	*2.11*	61.31	*60.57*	6.60	*8.95*	10.54	7.68
3.79	*3.60*	54.58	*48.00*	6.82	*13.00*	10.21	7.79
5.97	*3.60*	50.01	*48.00*	9.69	*13.00*	10.92	7.91
6.94	*3.60*	51.45	*48.00*	8.86	*13.00*	8.03	8.34
6.65	*3.60*	53.86	*48.00*	7.58	*13.00*	10.20	7.15
7.50	*3.60*	43.19	*48.00*	9.09	*13.00*	10.77	7.14
8.22	*3.60*	46.46	*48.00*	8.09	*13.00*	8.38	6.97
7.30	*3.60*	46.11	*48.00*	7.99	*13.00*	9.52	8.33
6.63	*3.60*	49.38	*48.00*	8.30	*13.00*	9.72	7.66
4.80	*3.00*	56.55	*55.03*	8.14	*9.57*	10.43	5.77
4.33	*2.00*	58.18	*58.00*	6.41	*10.00*	10.21	7.18
5.21	*2.00*	55.90	*58.00*	8.45	*10.00*	10.00	7.06
5.41	*2.00*	56.61	*58.00*	7.09	*10.00*	9.34	7.74
5.61	*2.00*	58.70	*58.00*	6.06	*10.00*	10.08	6.24
6.82	*2.00*	55.56	*58.00*	6.55	*10.00*	10.33	6.11
7.24	*2.00*	54.60	*58.00*	5.90	*10.00*	11.85	6.10
6.70	*2.00*	54.22	*58.00*	6.38	*10.00*	10.78	6.11
6.14	*2.00*	56.47	*58.00*	5.80	*10.00*	11.03	5.75
6.46	*2.00*	56.67	*58.00*	6.02	*10.00*	10.27	6.14
8.08	*2.00*	55.23	*58.00*	7.01	*10.00*	9.47	4.78
6.48	*2.00*	54.00	*58.00*	7.93	*10.00*	9.18	5.91
4.86	*2.00*	64.08	*58.00*	6.10	*10.00*	10.40	2.93
6.60	*2.00*	54.40	*58.00*	6.92	*10.00*	10.79	6.36
6.15	*2.00*	56.51	*58.00*	6.66	*10.00*	10.28	6.03

CHOPS.

4.07	*3.00*	71.85	*39.00*	1.90	*19.50*	10.95	1.35
3.97	*3.00*	72.00	*39.00*	1.96	*19.50*	11.49	1.33
3.69	*3.00*	72.40	*39.00*	1.97	*19.50*	12.17	1.27
5.33	*3.00*	69.83	*39.00*	2.87	*19.50*	10.19	1.53
4.01	*3.00*	73.30	*39.00*	1.96	*19.50*	10.15	1.27
4.21	*3.00*	71.88	*39.00*	2.13	*19.50*	10.99	1.35
4.14	*5.00*	71.03	*69.06*	1.95	*3.01*	11.94	1.25
4.31	*5.00*	72.92	*69.06*	2.06	*3.01*	9.56	1.40
4.23	*5.00*	71.96	*69.06*	2.01	*3.01*	10.75	1.33

CORN

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
E. C. Buchanan, **Memphis, Tenn.** Andes Corn Chops.	5	1672	9.25	*9.25*
	2	2048	8.94	*9.25*
Average	7		9.10	*9.25*
T. H. Bunch, **Little Rock, Ark.** **Corn Chops.**	4	2005	9.19	*6.00*
	21	697	9.31	*6.00*
	22	1632	9.06	*6.00*
	13	856	9.31	*6.00*
	48	923	8.69	*6.00*
	41	1037	9.13	*6.00*
	41	1150	8.88	*6.00*
	9	1267	8.69	*6.00*
	18	1346	9.13	*6.00*
	5	1527	8.69	*6.00*
	17	1783	9.00	*6.00*
	8	1901	9.19	*6.00*
	26	2211	9.19	*6.00*
Average	273		9.04	*6.00*
Corn Chops.	3	876	9.31	*9.88*
	3	1130	9.46	*9.88*
	2	1674	9.22	*9.88*
Average	8		9.33	*9.88*
Burrus Mill and Elevator Co., **Fort Worth, Texas.** **Burrus Corn Chops.**	4	1224	10.06	*8.53*
	3	1511	9.25	*8.53*
	2	1812	10.06	*8.53*
Average	9		9.79	*8.53*
Caldwell Milling Co., **Caldwell, Kan.** Corn Chops.	1	1061	9.94	*9.76*
	1	1488	8.94	*9.76*
Average	2		9.44	*9.76*
Charleston Milling Co., **Charleston, Mo.** Corn Chops.	3	1592	9.06	*12.00*

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed.	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.90	*3.87*	73.59	*70.37*	1.99	*1.56*	9.98	1.29
3.09	*3.87*	73.79	*70.37*	1.51	*1.56*	11.60	1.07
3.50	*3.87*	73.68	*70.37*	1.75	*1.56*	10.79	1.18
3.85	*3.00*	73.07	*60.00*	2.20	*22.00*	10.23	1.46
4.70	*3.00*	72.32	*60.00*	2.04	*22.00*	10.27	1.36
3.99	*3.00*	73.29	*60.00*	2.16	*22.00*	10.14	1.36
4.61	*3.00*	71.01	*60.00*	2.21	*22.00*	11.62	1.24
4.20	*3.00*	72.45	*60.00*	1.82	*22.00*	11.64	1.20
4.10	*3.00*	72.90	*60.00*	2.11	*22.00*	10.51	1.25
4.09	*3.00*	71.43	*60.00*	2.20	*22.00*	12.07	1.33
4.28	*3.00*	72.07	*60.00*	2.22	*22.00*	11.35	1.39
4.63	*3.00*	71.28	*60.00*	2.20	*22.00*	11.37	1.39
3.64	*3.00*	72.72	*60.00*	2.23	*22.00*	11.54	1.18
3.69	*3.00*	73.39	*60.00*	2.33	*22.00*	10.24	1.35
3.70	*3.00*	73.57	*60.00*	2.28	*22.00*	9.98	1.28
3.64	*3.00*	72.42	*60.00*	2.26	*22.00*	11.18	1.31
4.09	*3.00*	72.45	*60.00*	2.17	*22.00*	10.94	1.31
3.92	*4.17*	71.55	*71.95*	2.05	*2.00*	11.92	1.25
3.88	*4.17*	71.65	*71.95*	2.38	*2.00*	11.12	1.51
4.05	*4.17*	72.33	*71.95*	2.05	*2.00*	11.05	1.30
3.95	*4.17*	71.85	*71.95*	2.16	*2.00*	11.36	1.35
4.14	*5.00*	71.35	*70.82*	2.20	*2.39*	10.91	1.34
4.29	*5.00*	70.76	*70.82*	2.61	*2.39*	11.69	1.40
3.52	*5.00*	71.97	*70.82*	2.83	*2.39*	10.32	1.30
3.98	*5.00*	71.36	*70.82*	2.55	*2.39*	10.97	1.35
4.57	*6.08*	69.47	*67.52*	2.96	*2.17*	11.56	1.50
3.80	*6.08*	72.87	*67.52*	2.36	*2.17*	10.55	1.48
4.19	*6.08*	71.16	*67.52*	2.66	*2.17*	11.06	1.49
3.57	*3.65*	74.79	*64.34*	2.09	*2.87*	9.13	1.36

CORN

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Cooley Milling Co.,	1	1083	8.81	*9.00*
Siloam Springs, Ark.	3	1288	9.50	*9.00*
Corn Chops.	1	1590	9.44	*9.00*
	2	1847	9.44	*9.00*
	1	1930	8.94	*9.00*
Average	8		9.23	*9.00*
Crescent Cereal Co.,				
Kansas City, Kan.	1	796	13.47	*8.62*
Cracked Corn.				
Corn Chops and Cracked Corn.	2	902	10.88	*8.65*
Cunningham Commission Co.,				
Little Rock, Ark.	17	696	9.25	*9.00*
Corn Chops.	9	855	9.75	*9.00*
	20	918	9.44	*9.00*
	12	1038	9.25	*9.00*
	18	1142	8.88	*9.00*
	15	1273	9.28	*9.00*
	15	1345	9.19	*9.00*
	13	1427	9.00	*9.00*
	3	1545	9.00	*9.00*
	30	1630	9.31	*9.00*
	20	1782	9.06	*9.00*
	7	1902	9.25	*9.00*
	2	2046	9.30	*9.00*
	10	2105	9.75	*9.00*
Average	191		9.27	*9.00*
The Davis Milling Co.,	1	1722	8.53	*8.00*
St. Joseph, Mo.	4	1903	9.19	*8.00*
Pure Corn Chops.	1	2079	9.50	*8.00*
	2	2137	9.06	*8.00*
Average	8		9.08	*8.00*
Elliott & Meyers,				
Superior, Neb.	4	1638	9.78	*8.00*
Corn Chops.	4	1788	9.87	*8.00*
Average	8		9.83	*8.00*
Fowler Commission Co.,				
Rosedale, Kan.	2	1416	9.06	*9.94*
Corn Chops.	1	1947	9.38	*9.94*
	2	2047	8.94	*9.94*
Average	5		9.13	*9.94*

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.82	*3.00*	72.71	*53.00*	1.95	*6.00*	11.41	1.30
4.56	*3.00*	72.01	*53.00*	2.12	*6.00*	10.47	1.34
3.72	*3.00*	72.64	*53.00*	2.04	*6.00*	10.78	1.38
3.21	*3.00*	74.06	*53.00*	2.05	*6.00*	9.89	1.35
3.85	*3.00*	72.79	*53.00*	1.83	*6.00*	11.45	1.14
3.83	*3.00*	72.84	*53.00*	2.00	*6.00*	10.80	1.30
3.73	*3.18*	69.39	*72.42*	2.24	*3.07*	10.13	1.04
4.45	*3.18*	70.18	*72.43*	2.12	*3.07*	11.08	1.29
4.65	*4.50*	72.25	*69.00*	2.13	*3.00*	10.40	1.32
4.52	*4.50*	71.90	*69.00*	2.04	*3.00*	10.48	1.31
4.17	*4.50*	72.23	*69.00*	2.26	*3.00*	10.62	1.28
4.04	*4.50*	72.39	*69.00*	2.63	*3.00*	10.22	1.47
3.88	*4.50*	72.50	*69.00*	2.10	*3.00*	11.29	1.35
3.75	*4.50*	71.88	*69.00*	2.40	*3.00*	11.10	1.59
4.80	*4.50*	70.87	*69.00*	2.22	*3.00*	11.43	1.49
4.08	*4.50*	71.47	*69.00*	2.42	*3.00*	11.65	1.38
4.11	*4.50*	71.70	*69.00*	2.29	*3.00*	11.56	1.34
3.98	*4.50*	72.62	*69.00*	2.30	*3.00*	10.45	1.34
3.96	*4.50*	73.65	*69.00*	2.12	*3.00*	9.83	1.38
3.95	*4.50*	72.98	*69.00*	2.30	*3.00*	10.23	1.29
3.65	*4.50*	72.20	*69.00*	2.08	*3.00*	11.57	1.25
4.03	*4.50*	71.15	*69.00*	1.93	*3.00*	11.86	1.28
4.11	*4.50*	72.17	*69.00*	2.24	*3.00*	10.91	1.36
3.74	*3.25*	74.06	*70.00*	1.88	*1.80*	10.64	1.15
4.13	*3.25*	73.07	*70.00*	2.35	*1.80*	9.95	1.31
3.30	*3.25*	73.76	*70.00*	1.87	*1.80*	10.31	1.20
3.56	*3.25*	72.62	*70.00*	2.18	*1.80*	11.27	1.31
3.69	*3.25*	73.38	*70.00*	2.07	*1.80*	10.54	1.24
4.50	*3.00*	72.57	*55.00*	2.25	*5.00*	9.65	1.25
4.09	*3.00*	72.76	*55.00*	2.00	*5.00*	9.85	1.43
4.30	*3.00*	72.67	*55.00*	2.13	*5.00*	9.75	1.34
3.80	*4.67*	71.07	*71.55*	2.02	*2.19*	12.63	1.42
3.48	*4.67*	72.66	*71.55*	2.05	*2.19*	11.08	1.35
4.26	*4.67*	72.91	*71.55*	2.02	*2.19*	10.65	1.22
3.85	*4.67*	72.21	*71.55*	2.03	*2.19*	11.45	1.33

CORN

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
B. F. Glover & Son Commission Co.,	10	701	9.56	*10.90*
New Orleans, La.	12	235	9.44	*10.90*
N. B. Chops.	12	1235	9.25	*10.90*
	6	1333	9.25	*10.90*
	9	1449	9.25	*10.90*
	7	870	10.38	*10.90*
	11	1570	9.50	*10.90*
	6	1689	9.16	*10.90*
	5	1797	9.75	*10.90*
	12	1886	9.47	*10.90*
	9	2012	9.06	*10.90*
	5	2108	9.50	*10.90*
Average	104		9.46	*10.90*
Green, Shoemaker & Co.,	4	1526	9.25	*8.44*
Crowley, La.	1	1762	9.00	*8.44*
Corn Chops.	1	1967	9.50	*8.44*
	2	2049	9.38	*8.44*
	1	2153	9.56	*8.44*
Average	9		9.34	*8.44*
Hamiter & Bushby,	29	967	8.63	*8.10*
Shreveport, La.	23	1106	8.94	*8.10*
Corn Chops .	16	1225	8.69	*8.10*
	29	1432	8.81	*8.10*
	8	1582	9.56	*8.10*
	4	1688	9.00	*8.10*
	83	1780	9.00	*8.10*
	35	1781	9.06	*8.10*
	52	1877	9.19	*8.10*
	49	2010	9.19	*8.10*
	25	2110	9.38	*8.10*
Average	353		9.04	*8.10*
Hammond Planting & Manufacturing Co.,	4	711	9.88	*7.05*
Hammond, La.	3	1055	8.31	*7.05*
Pure Corn Chops.	1	1591	9.38	*7.05*
	2	1935	9.63	*7.05*
	1	2038	9.44	*7.05*
Average	11		9.33	*7.05*
Corn and Cob Chops.	1	1999	8.72	*7.10*
	1	2036	8.50	*7.10*
Average	2		8.61	*7.10*

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.92	*2.90*	71.54	*70.30*	2.26	*1.90*	11.34	1.38
4.28	*2.90*	72.63	*70.30*	2.35	*1.90*	9.78	1.52
3.62	*2.90*	72.96	*70.30*	2.04	*1.90*	10.90	1.23
3.90	*2.90*	72.08	*70.30*	2.04	*1.90*	11.45	1.28
3.82	*2.90*	71.94	*70.30*	2.12	*1.90*	11.51	1.36
4.42	*2.90*	69.67	*70.30*	2.28	*1.90*	11.90	1.35
4.12	*2.90*	72.95	*70.30*	2.17	*1.90*	9.87	1.39
3.84	*2.90*	73.78	*70.30*	2.25	*1.90*	9.70	1.27
3.53	*2.90*	73.20	*70.30*	2.17	*1.90*	10.02	1.33
3.75	*2.90*	72.64	*70.30*	2.48	*1.90*	10.30	1.36
3.98	*2.90*	71.71	*70.30*	2.40	*1.90*	11.60	1.25
3.50	*2.90*	71.25	*70.30*	2.21	*1.90*	12.18	1.36
3.89	*2.90*	72.20	*70.30*	2.23	*1.90*	10.88	1.34
3.60	*4.19*	72.05	*69.92*	2.17	*1.95*	11.61	1.32
3.37	*4.19*	73.81	*69.92*	2.06	*1.95*	10.31	1.45
3.15	*4.19*	73.40	*69.92*	2.50	*1.95*	9.80	1.65
3.91	*4.19*	72.26	*69.92*	1.89	*1.95*	11.23	1.33
3.90	*4.19*	72.02	*69.92*	1.96	*1.95*	11.30	1.26
3.59	*4.19*	72.71	*69.92*	2.11	*1.95*	10.85	1.40
3.12	*5.00*	73.14	*72.70*	1.72	*2.00*	12 33	1 06
4.41	*5.00*	72.13	*72.70*	2.21	*2.00*	10.99	1.32
3.91	*5.00*	74.11	*72.70*	1.88	*2.00*	10.17	1.24
3.53	*5.00*	72.76	*72.70*	2.18	*2.00*	11.43	1.29
4.11	*5.00*	72.06	*72.70*	2.31	*2.00*	10.50	1.46
3.09	*5.00*	73.92	*72.70*	2.12	*2.00*	10.62	1.25
4.09	*5.00*	73.38	*72.70*	2.12	*2.00*	10.01	1.40
4.10	*5.00*	73.10	*72.70*	2.00	*2.00*	10.31	1.43
3.78	*5.00*	72.36	*72.70*	2.05	*2.00*	11.33	1.29
4.28	*5.00*	72.67	*72.70*	2.28	*2.00*	10.17	1.41
3.43	*5.00*	72.29	*72.70*	1.91	*2.00*	11,81	1.18
3.81	*5.00*	72.90	*72 70*	2.07	*2.00*	10.88	1.30
4.15	*3.01*	71.06	*70.00*	1.90	*5.00*	11.60	1.41
3.79	*3.01*	73.69	*70.00*	2.04	*5.00*	10.94	1.23
3.02	*3.01*	73.27	*70.00*	2.14	*5.00*	10.75	1.44
3.90	*3.01*	72.43	*70.00*	2.18	*5.00*	10.60	1.26
3.30	*3.01*	73.31	*70.00*	2.05	*5.00*	10.71	1.19
3.63	*3.01*	72.75	*70.00*	2.06	*5.00*	10.92	1.31
3.60	*4.00*	67.75	*68.00*	7.20	*7.10*	11.13	1.60
3.65	*4.00*	69.05	*68.00*	6.73	*7.10*	10.63	1.44
3.63	*4.00*	68.40	*68.00*	6.96	*7,10*	10.88	1.52

CORN

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Higginsville Milling Co., **Higginsville, Mo.** Corn Chops.	1	1931	9.00	*7.49*
	1	2080	9.00	*7.49*
	1	2154	9.44	*7.49*
Average	3		9.15	*7.49*
Houk Grain Co., **Beaumont, Tex.** Corn Chops.	1	1735	9.75	*9.01*
Josey Grain Co., **Texarkana, Texas.** Yellow Rose Corn Chops.	5	1685	9.38	*9.00*
Josey Miller Co., **Beaumont, Texas.** Corn Chops.	2	1528	9.13	*9.00*
Kelley, Weber & Co., **Lakes Charles, La.** Corn Chops.	3	742	8.38	*10.03*
	10	916	8.94	*10.03*
	15	1112	9.19	*10.03*
	10	1183	9.13	*10.03*
	7	1290	9.44	*10.03*
	5	1332	8.88	*10.03*
	10	1434	8.69	*10.03*
	5	1504	9.06	*10.03*
	6	1567	9.13	*10.03*
	2	1711	9.01	*10.03*
	4	1790	9.06	*10.03*
	6	1893	9.50	*10.03*
	10	2013	9.80	*10.03*
	5	2096	9.38	*10.03*
Average	98		9.11	*10.03*
Kimball Fowler Co., **Kansas City, Mo.** Corn Chops.	2	1380	9.38	*9.88*
	3	1817	8.93	7.90
Corn Chops.	2	1576	9.56	7.90
	2	1710	9.09	7.90
Average	7		9.19	7.90

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.60	*3.87*	72.60	*55.28*	2.18	*3.78*	11.38	1.24
3.02	*3.87*	73.34	*55.28*	2.30	*3.78*	10.98	1.36
3.74	*3.87*	72.38	*55.28*	1.97	*3.78*	11.22	1.25
3.45	*3.87*	72.77	*55.28*	2.15	*3.78*	11.19	1.29
3.60	*3.24*	73.82	*70.00*	2.21	*2.00*	9.39	1.23
4.10	*3.00*	72.56	*65.00*	2.13	*12.00*	10.50	1.33
3.46	*4.00*	71.39	*70.00*	2.37	*2.00*	12.23	1.42
4.23	*5.00*	73.96	*70.04*	1.95	*2.02*	10.04	1.44
3.68	*5.00*	72.44	*70.04*	1.85	*2.02*	11.88	1.21
3.60	*5.00*	73.79	*70.04*	1.79	*2.02*	10.42	1.21
3.60	*5.00*	72.57	*70.04*	2.02	*2.02*	11.42	1.26
3.04	*5.00*	73.90	*70.04*	1.75	*2.02*	10.53	1.34
3.21	*5.00*	73.46	*70.04*	1.90	*2.02*	11.32	1.23
3.49	*5.00*	73.34	*70.04*	1.91	*2.02*	11.32	1.25
3.57	*5.00*	72.62	*70.04*	1.99	*2.02*	11.45	1.31
3.10	*5.00*	73.85	*70.04*	1.99	*2.02*	10.59	1.34
3.42	*5.00*	73.56	*70.04*	2.12	*2.02*	10.54	1.35
3.80	*5.00*	73.71	*70.04*	2.52	*2.02*	9.41	1.50
4.15	*5.00*	73.75	*70.04*	2.23	*2.02*	9.03	1.34
3.95	*5.00*	73.16	*70.04*	2.15	*2.02*	10.29	1.45
3.87	*5.00*	71.36	*70.04*	1.95	*2.02*	12.12	1.32
3.62	*5.00*	73.22	*70.04*	2.00	*2.02*	10.73	1.32
3.95	*4.17*	71.99	*71.95*	1.96	*2.00*	11.33	1.39
4.03	*4.20*	73.31	*73.10*	2.25	*2.30*	10.13	1.35
3.46	*4.20*	72.78	*73.10*	1.94	*2.30*	10.89	1.37
3.82	*4.20*	73.27	*73.10*	2.22	*2.30*	10.40	1.20
3.77	*4.20*	73.12	*73. 0*	2.14	*2.30*	10.47	1.31

CORN

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Henry A. Klyce Co., **Dyersburg, Tenn.** Corn Chops.	12	1099	9.00	*15.01*
	7	1258	8.44	*15.01*
	9	1501	7.94	*15.01*
	3	1355	8.13	*15.01*
	11	1581	8.69	*15.01*
	9	1687	8.88	*15.01*
	6	1799	10.06	*15.01*
Average	57		8.73	*15.01*
Lang & Marsh, **Jennings, La.** Corn Chops.	3	1637	9.69	*10.00*
Laning Harris Coal & Grain Co., **Kansas City, Mo.** Sunflower Pure Corn Chops.	12	966	9.13	*8.62*
	3	1189	8.88	*8.62*
	8	688	8.75	*8.62*
	1	1608	8.88	*8.62*
Average	24		8.91	*8.62*
H. T. Fowler Manufacturing & Produce Co., **New Orleans, La.** Cracked Corn.	2	1188	9.31	*14.85*
	1	1973	10.78	*14.85*
Average	3		10.05	*14.85*
Lev Fowler, **Kansas City, Mo.** Corn Chops.	6	745	8.88	*7.80*
	27	920	8.44	*7.80*
	30	1027	9.31	*7.80*
	6	1144	8.88	*7.80*
	22	1250	8.81	*7.80*
	7	1340	8.63	*7.80*
	14	1438	8.19	*7.80*
	4	1495	9.31	*7.80*
	12	1564	9.25	*7.80*
	7	1681	9.50	*7.80*
	16	1779	9.00	*7.80*
	18	1878	9.13	*7.80*
	28	2009	9.38	*7.80*
	8	2103	9.19	*7.80*
Average	205		8.99	*7.80*

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Found
3.88	*4.09*	70.26	*61.84*	3.74	*5.10*	11.76	1.36
3.12	*4.09*	71.59	*61.84*	4.43	*5.10*	11.13	1.29
3.12	*4.09*	73.04	*61.84*	3.90	*5.10*	10.77	1.23
2.78	*4.09*	72.67	*61.84*	3.43	*5.10*	11.48	1.51
3.47	*4.09*	72.11	*61.84*	3.75	*5.10*	10.79	1.19
2.90	*4.09*	72.92	*61.84*	3.99	*5.10*	10.05	1.26
3.34	*4.09*	70.22	*61.84*	5.04	*5.10*	10.01	1.33
3.23	*4.09*	71.83	*61.84*	4.04	*5.10*	10.86	1.31
3.68	*5.00*	72.18	*70.00*	2.08	*2.02*	10.96	1.41
4.09	*3.18*	71.46	*72.42*	2.07	*2.07*	11.96	1.29
3.32	*3.18*	73.36	*72.42*	2.01	*2.07*	10.98	1.45
4.54	*3.18*	72.57	*72.42*	1.99	*2.07*	10.75	1.40
3.47	*3.18*	74.94	*72.42*	1.66	*2.07*	9.92	1.13
3.86	*3.18*	73.08	*72.42*	1.93	*2.07*	10.90	1.32
5.03	*3.58*	71.35	*54.00*	2.16	*10.00*	10.60	1.55
3.38	*3.58*	72.24	*54.00*	1.78	*10.00*	10.43	1.39
4.20	*3.58*	71.80	*54.00*	1.97	*10.00*	10.51	1.47
3.95	*4.20*	72.72	*72.32*	1.80	*3.10*	11.31	1.34
3.93	*4.20*	72.88	*72.32*	2.12	*3.10*	11.39	1.24
3.75	*4.20*	73.07	*72.32*	1.95	*3.10*	10.64	1.28
4.67	*4.20*	72.77	*72.32*	2.12	*3.10*	10.14	1.42
3.91	*4.20*	73.80	*72.32*	1.71	*3.10*	10.48	1.29
4.21	*4.20*	73.36	*72.32*	1.96	*3.10*	10.54	1.30
3.85	*4.20*	72.61	*72.32*	2.04	*3.10*	11.93	1.38
3.62	*4.20*	73.10	*72.32*	1.97	*3.10*	10.68	1.32
3.40	*4.20*	73.02	*72.32*	1.94	*3.10*	11.17	1.22
3.68	*4.20*	73.38	*72.32*	2.11	*3.10*	9.95	1.38
4.67	*4.20*	72.48	*72.32*	2.19	*3.10*	10.23	1.43
3.73	*4.20*	72.69	*72.32*	2.05	*3.10*	11.12	1.28
4.68	*4.20*	71.83	*72.32*	2.13	*3.10*	10.55	1.43
3.72	*4.20*	71.61	*72.32*	1.95	*3.10*	12.37	1.16
3.99	*4.20*	72.81	*72.32*	2.00	*3.10*	10.89	1.32

CORN

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Louisiana Grain and Milling Co., **Lake Charles, La.** Corn Chops.	9	689	9.44	*8.75*
	22	919	8.38	*8.75*
	10	1033	8.63	*8.75*
	3	1034	8.81	*8.75*
	15	1115	8.81	*8.75*
	12	1269	9.38	*8.75*
	4	1364	9.06	*8.75*
	3	1448	9.06	*8.75*
	10	1556	9.00	*8.75*
	2	1701	9.15	*8.75*
	9	1777	8.50	*8.75*
	3	1915	9.00	*8.75*
	6	2014	8.94	*8.75*
	2	2135	9.83	*8.75*
Average	110		9.00	*8.75*
Lukens Milling Co., **Atchison, Kan.** Corn Chops.	2	1483	8.81	*7.50*
	1	1723	8.93	*7.50*
Average	3		8.87	*7.50*
R. W. Lyon, **Gueydan, La.** Corn Chops.	1	1056	8.94	*8.00*
Marshall & Michel, **Kansas City, Mo.** Corn Chops.	1	1675	8.88	*8.00*
	1	2155	10.56	*8.00*
Average	2		9.72	*8.00*
Missouri & Kansas Grain Co., **Neosho, Mo.** Corn Chops.	3	735	9.44	*10.00*
	8	984	9.06	*10.00*
	9	1164	8.78	*10.00*
	10	1428	8.56	*10.00*
	18	1510	8.81	*10.00*
	7	1565	8.94	*10.00*
	1	1721	8.96	*10.00*
	3	1818	8.62	*10.00*
	10	2026	8.88	*10.00*
Average	69		8.89	*10.00*

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed.	% Found	% Found
4.50	*3.25*	71.71	*75.25*	1.90	*1.50*	11.10	1.35
3.64	*3.25*	73.99	*75.25*	1.95	*1.50*	10.88	1.16
3.61	*3.25*	73.90	*75.25*	1.93	*1.50*	10.52	1.41
3.41	*3.25*	73.93	*75.25*	2.15	*1.50*	10.95	1.29
3.54	*3.25*	72.12	*75.25*	1.87	*1.50*	12.37	1.29
3.23	*3.25*	73.43	*75.25*	1.68	*1.50*	11.04	1.24
4.07	*3.25*	71.83	*75.25*	2.08	*1.50*	11.61	1.35
3.68	*3.25*	71.01	*75.25*	1.90	*1.50*	13.02	1.33
3.37	*3.25*	73.60	*75.25*	1.82	*1.50*	10.93	1.28
3.50	*3.25*	73.75	*75.25*	2.16	*1.50*	10.19	1.25
3.58	*3.25*	74.93	*75.25*	2.07	*1.50*	9.59	1.33
3.13	*3.25*	73.09	*75.25*	1.72	*1.50*	11.60	1.43
3.50	*3.25*	73.79	*75.25*	1.95	*1.50*	10.49	1.33
4.42	*3.25*	71.00	*75.25*	2.19	*1.50*	11.23	1.23
3.65	*3.25*	73.00	*75.25*	1.95	*1.50*	11.10	1.30
3.72	*3.00*	72.32	*65.00*	2.24	*5.00*	11.61	1.30
4.07	*3.00*	72.83	*65.00*	2.37	*5.00*	10.50	1.30
3.90	*3.00*	72.58	*65.00*	2.30	*5.00*	11.05	1.30
4.07	*3.50*	73.57	*69.00*	1.93	*4.00*	10.26	1.23
3.00	*3.00*	74.65	*65.00*	2.09	*10.00*	10.20	1.19
3.45	*3.00*	71.40	*65.00*	2.26	*10.00*	20.78	1.55
3.22	*3.00*	73.03	*65.00*	2.17	*10.00*	10.49	1.37
4.80	*3.50*	70.82	*53.00*	2.41	*10.00*	11.20	1.33
4.03	*3.50*	71.81	*53.00*	2.00	*10.00*	11.91	1.19
3.50	*3.50*	73.10	*53.00*	1.69	*10.00*	11.75	1.18
3.70	*3.50*	72.41	*53.00*	1.99	*10.00*	12.20	1.14
3.70	*3.50*	73.59	*53.00*	1.92	*10.00*	10.84	1.14
3.87	*3.50*	73.17	*53.00*	1.95	*10.00*	10.88	1.19
3.99	*3.50*	72.86	*53.00*	2.01	*10.00*	10.85	1.33
3.47	*3.50*	74.12	*53.00*	2.09	*10.00*	10.35	1.35
3.55	*3.50*	72.39	*53.00*	1.99	*10.00*	11.92	1.27
3.84	*3.50*	72.70	*53.00*	2.01	*10.00*	11.32	1.24

CORN

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
McEwen Grain Co., **Kansas City, Mo.** Corn Chops.	3	982	9.94	*13.00*
	3	1245	8.94	*13.00*
	2	1709	9.53	*13.00*
	3	1913	9.50	*13.00*
Average	11		9.48	*13.00*
Nelson Grain Co., **Kansas City, Mo.** Pure Corn Chops.	17	695	8.88	*8.01*
	33	921	8.81	*8.01*
	34	1114	9.44	*8.01*
	22	1186	8.94	*8.01*
	15	1268	8.38	*8.01*
	12	1337	8.94	*8.01*
	12	1538	8.81	*8.01*
	16	1631	9.72	*8.01*
	7	1800	9.06	*8.01*
	1	1998	8.94	*8.01*
	8	2011	9.63	*8.01*
	31	2112	9.56	*8.01*
Average	208		9.09	*8.01*
Diamond Corn Chops.	1	1013	9.31	*8.50*
Newport Grocer Co., **Newport, Ark.** Corn Chops.	3	865	10.25	*9.00*
Oswego Milling Co., **Oswego, Kan.** Corn Chops.	1	2073	9.50	*12.12*
	1	2152	10.06	*12.12*
Average	2		9.78	*12.12*
Pearl Roller Mills, **Oswego, Kan.** Corn Chops.	2	1852	9.25	8.00
Pittsburg M. M. Co., **Pittsburg, Kan.** Corn Chops.	3	750	9.06	*8.48*
	7	954	9.50	*8.48*
	1	1949	8.88	*8.48*
Average	11		9.15	*8.48*

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.96	*4.04*	71.25	*69.26*	2.12	*2.80*	11.47	1.26
4.14	*4.04*	72.96	*69.26*	1.97	*2.80*	10.69	1.30
3.77	*4.04*	73.19	*69.26*	2.20	*2.80*	9.96	1.35
3.88	*4.04*	71.60	*69.26*	2.43	*2.80*	11.30	1.29
3.94	*4.04*	72.25	*69.26*	2.18	*2.80*	10.85	1.30
3.98	*5.00*	72.75	*72.07*	1.96	*2.00*	11.12	1.31
3.55	*5.00*	72.53	*72.07*	1.90	*2.00*	12.00	1.21
4.40	*5.00*	72.31	*72.07*	2.03	*2.00*	10.48	1.34
3.62	*5.00*	73.05	*72.07*	2.02	*2.00*	11.09	1.28
3.95	*5.00*	72.95	*72.07*	2.00	*2.00*	11.36	1.36
3.78	*5.00*	72.05	*72.07*	2.28	*2.00*	11.65	1.30
3.83	*5.00*	72.12	*72.07*	2.03	*2.00*	11.89	1.32
3.93	*5.00*	73.02	*72.07*	1.96	*2.00*	10.03	1.34
3.49	*5.00*	73.79	*72.07*	2.12	*2.00*	10.16	1.38
4.33	*5.00*	72.80	*72.07*	2.50	*2.00*	10.20	1.23
5.13	*5.00*	71.60	*72.07*	2.68	*2.00*	9.50	1.46
3.55	*5.00*	72.26	*72.07*	2.11	*2.00*	11.36	1.16
3.96	*5.00*	72.60	*72.07*	2.13	*2.00*	10.91	1.31
4.12	*4.50*	71.79	*71.09*	1.99	*4.20*	11.40	1.39
4.82	*4.50*	69.51	*69.00*	2.37	*2.00*	11.72	1.33
4.64	*3.77*	70.71	*66.29*	2.58	*2.17*	11.24	1.33
5.39	*3.77*	69.06	*66.29*	2.69	*2.17*	11.21	1.59
5.02	*3.77*	69.89	*66.29*	2.63	*2.17*	11.22	1.46
4.51	*3.25*	72.18	*72.98*	2.52	*1.62*	10.29	1.25
4.12	*4.89*	71.99	*69.71*	1.88	*2.43*	11.83	1.12
4.20	*4.89*	70.71	*69.71*	2.15	*2.43*	12.10	1.34
3.35	*4.89*	73.36	*69.71*	2.03	*2.43*	11.13	1.25
3.89	*4.89*	72.02	*69.71*	2.02	*2.43*	11.69	1.23

CORN

Name of Manufacturer of Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed.
Russell Grain Co., **Kansas City, Mo.** Square Deal Pure Corn Chops.	1	1414	8.53	8.02
	1	2043	8.63	8.02
Average	2		8.58	8.02
Scott County Milling Co., **Sikestown and Oran, Mo.** Corn Chops.	10	1555	9.56	8.70
	2	1703	8.96	8.70
	6	1798	9.03	8.70
Average	18		9.19	8.70
Scott County Milling Co., **Sikeston, Mo.** Corn Chops.	5	1639	9.81	9.88
Seneca Mill & Elevator Co., **Seneca, Mo.** Corn Chops.	4	774	8.25	8.75
	7	952	9.38	8.75
	7	1249	9.06	8.75
	3	1470	8.81	8.75
	7	1657	9.13	8.75
	4	1787	9.31	8.75
	2	2119	9.44	8.75
Average	34		9.06	8.75
Southern Grain Co., **Kansas City, Mo.** Corn Chops.	4	943	9.81	9.04
	3	1177	8 91	9.04
	1	1531	8.31	9.04
	3	1682	9.31	9.04
	2	1850	9.31	9.04
	2	1938	9.31	9.04
	1	2039	10.35	9.04
Average	16		9.33	9.04
Stark Grain Co., **Plano, Texas, and Texarkana, Ark.** Horse Shoe Corn Chops.	4	1132	9.09	7.10
	1	1479	8.19	7.10
Average	5		8.64	7.10

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
4.23	*4.03*	72.79	*73.07*	2.00	*2.00*	11.12	1.33
3.55	*4.03*	73.13	*73.07*	2.17	*2.00*	11.27	1.25
3.89	*4.03*	72.96	*73.07*	2.09	*2.00*	11.19	1.29
4.16	*4.55*	71.74	*73.12*	2.14	*1.83*	11.04	1.36
4.05	*4.55*	72.95	*73.12*	2.18	*1.83*	10.43	1.43
3.49	*4.55*	74.44	*73.12*	1.92	*1.83*	9.79	1.33
3.90	*4.55*	73.04	*73.12*	2.08	*1.83*	10.42	1.37
4.07	*4.17*	72.89	*71.95*	2.04	*2.00*	9.77	1.42
4.05	*5.02*	71.49	*70.63*	1.95	*1.95*	13.13	1.13
4.26	*5.02*	71.48	*70.63*	1.91	*1.95*	11.56	1.41
4.30	*5.02*	72.28	*70.63*	2.13	*1.95*	10.82	1.41
3.60	*5.02*	72.70	*70.63*	1.76	*1.95*	11.92	1.21
4.02	*5.02*	73.79	*70.63*	2.19	*1.95*	9.60	1.27
3.68	*5.02*	74.30	*70.63*	2.04	*1.95*	9.42	1.25
4.03	*5.02*	72.39	*70.63*	2.05	*1.95*	10.91	1.18
3.99	*5.02*	72.63	*70.63*	2.00	*1.95*	11.05	1.27
4.00	*3.06*	71.17	*72.03*	2.11	*2.03*	11.65	1.26
3.44	*3.06*	72.83	*72.63*	1.94	*2.03*	11.55	1.33
2.76	*3.06*	74.02	*72.03*	1.59	*2.03*	12.23	1.09
3.96	*3.06*	73.22	*72.03*	2.38	*2.03*	9.79	1.34
3.58	*3.06*	75.29	*72.03*	1.95	*2.03*	8.52	1.35
3.40	*3.06*	72.99	*72.03*	2.13	*2.03*	10.98	1.19
5.60	*3.06*	68.90	*72.03*	3.14	*2.03*	10.46	1.55
3.82	*3.06*	72.63	*72.03*	2.18	*2.03*	10.74	1.30
4.56	*5.00*	70.99	*65.00*	2.28	*14.00*	11.73	1.35
3.50	*5.00*	73.55	*65.00*	1.86	*14.00*	11.62	1.28
4.03	*5.00*	72.27	*65.00*	2.07	*14.00*	11.67	1.32

CORN

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Stanard Tilton Milling Co., **Dallas, Tex.** Corn Chops.	1	1539	9.19	*12.85*
	2	1914	9.63	*12.85*
	1	2074	10.13	*12.85*
	1	2151	10.38	*12.85*
Average	5		9.83	*12.85*
Texas Star Flour Mills, **Galveston, Texas.** Corn Chops.	1	1699	9.68	*9.47*
	2	1848	9.78	*9.47*
	1	2133	9.63	*9.47*
Average	4		9.70	*9.47*
Valley Milling Co., **St. Louis, Mo.** Cracked Corn and Corn Chops.	1	1602	8.69	*11.00*
The S. R. Washer Grain Co., **Atchison, Kan.** Washer Corn Chops.	6	710	8.94	*8.00*
	2	906	9.06	*8.00*
	13	960	8.69	*8.00*
	9	1149	9.25	*8.00*
	8	1291	9.44	*8.00*
	7	1331	8.88	*8.00*
	5	1421	8.63	*8.00*
	1	1763	9.37	*8.00*
	14	1778	9.00	*8.00*
	10	1889	9.44	*8.00*
	3	2021	9.13	*8.00*
	8	2107	9.63	*8.00*
Average	86		9.12	*8.00*
Webb & Maury, **Memphis, Tenn.** Corn Chops.	6	708	10.12	*8.03*
	20	866	9.94	*8.03*
	2	1093	8.94	*8.03*
	8	1163	9.19	*8.03*
	2	1301	9.31	*8.03*
	1	1720	8.81	*8.03*
	2	2045	9.00	*8.03*
Average	41		9.33	*8.03*
Yukon Mill & Grain Co., **Yukon, Okla.** Chops.	1	1415	8.88	*11.07*

CHOPS.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.77	*7.85*	72.50	*56.40*	1.94	*8.25*	11.36	1.24
2.80	*7.85*	73.92	*56.40*	2.18	*8.25*	10.08	1.39
4.82	*7.85*	70.68	*56 40*	2.30	*8.25*	10.68	1.39
4.20	*7.85*	70.96	*56.40*	1.90	*8.25*	11.23	1.33
3.90	*7.85*	72.01	*56.40*	2.08	*8.25*	10.84	1.34
4.08	*3.85*	72.11	*69.12*	2.42	*3.44*	10.23	1.48
3.76	*3.85*	74.31	*69.12*	2.35	*3.44*	8.35	1.45
4 20	*3.85*	72.11	*69.12*	2.10	*3.44*	10.65	1.31
4.01	*3.85*	72.85	*69.12*	2.29	*3.44*	9.74	1.41
3.81	*4.50*	72.62	*70.00*	2.13	*2.00*	11.43	1.32
4.02	*4.00*	72.68	*55.50*	1.68	*5.50*	11.45	1.23
4.13	*4.00*	72.08	*55.50*	1.98	*5.50*	11.49	1.26
4.33	*4.00*	71.24	*55.50*	1.92	*5.50*	12.38	1.44
4.14	*4.00*	71.21	*55.50*	2.14	*5.50*	12.00	1.26
3.71	*4.00*	73.22	*55.50*	1.73	*5.50*	10.65	1.25
3.65	*4.00*	72.63	*55.50*	2.00	*5.50*	11·50	1.34
3.59	*4.00*	72.68	*55.50*	2.00	*5.50*	11.91	1.19
4.34	*4.00*	72.67	*55.50*	2.14	*5.50*	10.15	1.33
4.22	*4.00*	72.48	*55.50*	2.28	*5.50*	10.74	1.28
3.75	*4.00*	73.55	*55.50*	2.20	*5.50*	9.78	1.28
4.10	*4.00*	72.18	*55.50*	2.26	*5.50*	11.06	1.27
3.50	*4.00*	71.83	*55.50*	1.87	*5.50*	12.00	1.17
3.96	*4.00*	72.37	*55.50*	2.01	*5.50*	11.26	1.28
3.90	*3.00*	71.53	*65.00*	2.17	*3.50*	10.80	1.48
5.06	*3.00*	69.63	*65.00*	2.05	*3.50*	12.02	1.30
3.99	*3.00*	73.35	*65.00*	2.02	*3.50*	10.38	1.32
3.80	*3.00*	72.72	*65.00*	1.83	*3.50*	11.18	1.28
3.96	*3.00*	74.17	*65.00*	2.36	*3.50*	8.82	1.38
3.81	*3.00*	73.68	*65.00*	2.16	*3.50*	10.16	1.38
4.02	*3.00*	72.23	*65.00*	1.91	*3.50*	11.56	1.28
4.08	*3.00*	72.47	*65.00*	2.07	*3.50*	10.70	1.35
4.47	*4.08*	70.03	*69.28*	3.20	*1.91*	12.11	1.31

CORN AND

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
American Cereal Co., Cedar Rapids, Iowa. Banner Feed.	8	1234	8.69	*8.00*
	16	1344	9.56	*8.00*
	4	1439	9.13	*8.00*
	13	1577	9.06	*8.00*
	7	1690	8.88	*8.00*
	16	1774	9.00	*8.00*
	7	1880	9.00	*8.00*
	4	2025	8.94	*8.00*
	2	2114	9.13	*8.00*
Average	77		9.04	*8.00*
Victor Corn and Oats.	2	668	7.59	*7.50*
	1	836	8.56	*7.50*
	2	1001	8.25	*7.50*
	6	1134	7.47	*7.50*
	8	1239	7.50	*7.50*
	4	1426	8.22	*7.50*
	6	1558	7.81	*7.50*
	2	1830	7.56	*7.50*
	2	1941	7.81	*7.50*
	1	2187	8.50	*7.50*
Average	34		7.93	*7.50*
Corno Mills Co., East St. Louis, Ill. Corno Creamo Dairy Feed. Corn, Oats, Gluten Feed and **Alfalfa.**	1	658	13.34	*15.50*
	3	780	13.16	*15.50*
	4	938	14.44	*15.50*
	6	1137	13.00	*15.50*
	4	1454	11.31	*15.50*
	2	1278	13.63	*15.50*
	5	1636	12.25	*15.50*
	3	1814	12.75	*15.50*
	1	1946	14.06	*15.50*
Average	29		13.10	*15.50*
Corno Horse and Mule Feed. Corn, Oats and Alfalfa.	5	777	9.15	*10.50*
	4	948	9.31	*10.50*
	21	1101	9.44	*10.50*
	13	1437	8.88	*10.50*
	8	1505	9.00	*10.50*
	16	1557	9.25	*10.50*
	3	643	10.78	*10.50*
	10	1304	8.78	*10.50*
	7	1795	9.37	*10.50*
	4	1896	10.06	*10.50*
	1	2068	10.94	*10.50*
	1	2188	10.19	*10.50*
Average	93		9.60	*10.50*

OAT FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Foun	% Guaranteed	% Found	% Found
3.37	*3.50*	65.11	*65.00*	9.43	*10.00*	10.25	3.15
3.31	*3.50*	64.37	*65.00*	9.29	*10.00*	10.38	3.19
3.23	*3.50*	63.80	*65.00*	8.58	*10.00*	11.99	3.27
3.64	*3.50*	62.50	*65.00*	10.90	*10.00*	10.31	3.59
3.23	*3.50*	65.35	*65.00*	10.24	*10.00*	9.15	3.15
2.95	*3.50*	65.99	*65.00*	9.93	*10.00*	8.75	3.38
2.90	*3.50*	64.61	*65.00*	10.18	*10.00*	10.40	2.91
2.93	*3.50*	63.75	*65.00*	11.00	*10.00*	10.17	3.21
3.06	*3.50*	64.38	*65.00*	9.73	*10.00*	10.62	3.08
3.18	*3.50*	64.42	*65.00*	9.92	*10.00*	10.23	3.21
3.22	*3.00*	65.16	*62.00*	9.90	*12.00*	10.92	3.21
3.22	*3.00*	60.70	*62.00*	11.78	*12.00*	12.01	3.73
3.24	*3.00*	64.45	*62.00*	10.56	*12.00*	10.26	3.24
3.18	*3.00*	62.07	*62.00*	12.34	*12.00*	11.23	3.71
3.12	*3.00*	62.71	*62.00*	12.94	*12.00*	10.08	3.65
3.27	*3.00*	60.71	*62.00*	12.24	*12.00*	11.78	3.78
3.09	*3.00*	62.30	*62.00*	12.30	*12.00*	10.87	3.63
3.12	*3.00*	66.26	*62.00*	10.19	*12.00*	9.74	3.13
3.00	*3.00*	63.86	*62.00*	11.80	*12.00*	10.38	3.15
3.12	*3.00*	64.47	*62.00*	11.05	*12.00*	9.65	3.21
3.16	*3.00*	63.27	*62.00*	11.51	*12.00*	10.69	3.44
3.63	*5.10*	47.57	*50.00*	19.53	*17.50*	9.59	6.34
4.00	*5.10*	49.19	*50.00*	18.18	*17.50*	10.90	4.57
3.84	*5.10*	49.27	*50.00*	17.09	*17.50*	9.36	6.00
3.35	*5.10*	50.67	*50.00*	18.08	*17.50*	9.79	5.09
2.88	*5.10*	49.17	*50.00*	19.42	*17.50*	10.85	6.37
3.14	*5.10*	48.68	*50.00*	20.45	*17.50*	7.97	6.13
2.97	*5.10*	51.65	*50.00*	18.99	*17.50*	8.53	5.61
2.92	*5.10*	51.88	*50.00*	18.45	*17.50*	8.77	5.23
2.13	*5.10*	43.24	*50.00*	24.25	*17.50*	10.30	6.02
3.21	*5.10*	49.04	*50.00*	19.38	*17.50*	9.56	5.71
3.77	*5.60*	61.13	*58.50*	10.01	*11.10*	12.67	3.27
3.31	*5.60*	55.71	*58.50*	15.13	*11.10*	11.31	5.23
3.85	*5.60*	59.76	*58.50*	12.06	*11.10*	10.80	4.09
2.69	*5.60*	55.88	*58.50*	15.70	*11.10*	11.39	5.46
3.23	*5.60*	60.55	*58.50*	13.32	*11.10*	9.52	4.38
3.21	*5.60*	58.73	*58.50*	13.62	*11.10*	10.68	4.51
2.56	*5.60*	56.20	*58.50*	13.16	*11.10*	12.03	5.27
3.09	*5.60*	62.94	*58.50*	12.49	*11.10*	8.73	3.97
2.45	*5.60*	58.18	*58.50*	15.63	*11.10*	9.39	4.98
2.90	*5.60*	58.46	*58.50*	14.65	*11.10*	9.00	4.93
3.74	*5.60*	58.85	*58.50*	11.70	*11.10*	11.03	3.74
3.07	*5.60*	58.97	*58.50*	12.02	*11.10*	11.56	4.25
3.15	*5.60*	58.78	*58.50*	13.29	*11.10*	10.68	4.50

CORN AND

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Corno Mills Co.,	1	1989	9.13	*10.00*
East St. Louis, Ill.	1	1243	9.00	*10.00*
(Continued.)	12	1775	9.87	*10.00*
Corno Horse and Mule Feed.				
Corn, Oats and Alfalfa.				
Average	14		9.33	*10.00*
	1	661	7.13	*7.62*
	2	784	6.94	*7.62*
	2	1003	7.31	*7.62*
Diamond C. Corn and Oat Chops.	6	1232	6.69	*7.62*
	2	1400	7.43	*7.62*
	3	1599	6.91	*7.62*
	2	1831	7.75	*7.62*
Average	18		7.17	*7.62*
Cunningham Com. Co.,				
Little Rock, Ark.	1	676	12.18	*13.00*
Pulaski Corn and Oat Chops.	1	1314	13.06	*13.00*
	2	1629	13.00	*13.00*
	1	1928	12.25	*13.00*
Average	5		12.62	*13.00*
Great Western Cereal Co.,				
Nebraska City, Neb.	1	662	8.06	*9.00*
Excelsior Corn and Oat Feed.	1	1045	9.19	*9.00*
	4	1223	8.87	*9.00*
	1	1606	9.06	*9.00*
	1	2067	8.94	*9.00*
	1	2189	9.31	*9.00*
Average	9		8.91	*9.00*
Great Western Cereal Co.,				
Chicago, Ill.	10	1297	9.13	*9.00*
Boss Corn and Oat Feed.	5	1440	8.69	*9.00*
	2	1670	9.31	*9.00*
	6	1819	8.25	*9.00*
	7	1909	7.88	*9.00*
	1	2065	7.94	*9.00*
	1	2186	8.94	*9.00*
Average	32		8.59	*9.00*

OAT FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.33	*3.50*	57.96	*58.50*	14.35	*12.00*	10.98	4.25
3.07	*3.50*	64.14	*58.50*	8.81	*12.00*	10.15	4.83
3.38	*3.50*	58.15	*58.50*	14.00	*12.00*	9.97	4.63
3.26	*3.50*	60.08	*58.50*	12.39	*12.00*	10.37	4.57
2.34	*3.15*	58.60	*61.28*	16.81	*14.73*	10.20	4.92
4.32	*3.15*	59.93	*61.28*	14.14	*14.73*	10.93	3.74
3.21	*3.15*	60.47	*61.28*	13.89	*14.73*	11.24	3.88
2.95	*3.15*	60.18	*61.28*	16.07	*14.73*	9.62	4.49
3.13	*3.15*	59.09	*61.28*	14.58	*14.73*	11.09	4.68
2.65	*3.15*	60.11	*61.28*	16.86	*14.73*	9.15	4.32
2.62	*3.15*	61.18	*61.28*	14.85	*14.73*	9.07	4.53
3.03	*3.15*	59.94	*61.28*	15.31	*14.73*	10.18	4.37
3.45	*4.00*	49.52	*55.00*	14.75	*12.00*	10.51	9.59
5.49	*4.00*	51.09	*55.00*	12.37	*12.00*	9.60	8.39
4.12	*4.00*	52.38	*55.00*	12.50	*12.00*	10.07	7.93
2.28	*4.00*	49.54	*55.00*	12.35	*12.00*	10.93	12.65
3.84	*4.00*	50.63	*55.00*	12.99	*12.00*	10.28	9.64
4.97	*4.02*	57.55	*60.00*	12.87	*10.00*	9.85	6.70
5.95	*4.02*	61.51	*60.00*	8.78	*10.00*	10.80	3.77
5.45	*4.02*	63.89	*60.00*	7.50	*10.00*	9.52	4.77
4.99	*4.02*	64.78	*60.00*	8.09	*10.00*	10.22	2.86
4.65	*4.02*	65.03	*60.00*	6.69	*10.00*	10.44	4.25
6.80	*4.02*	62.74	*60.00*	8.01	*10.00*	10.13	3.01
5.47	*4.02*	62.58	*60.00*	8.65	*10.00*	10.16	4.23
5.12	*4.20*	61.80	*60.00*	10.01	*11.00*	9.08	4.86
4.68	*4.20*	62.36	*60.00*	9.46	*11.00*	11.24	3.57
4.76	*4.20*	63.57	*60.00*	9.71	*11.00*	9.26	3.39
4.24	*4.20*	65.16	*60.00*	10.08	*11.00*	8.72	3.55
3.30	*4.20*	61.97	*60.00*	13.50	*11.00*	9.78	3.57
2.05	*4.20*	62.77	*60.00*	12.31	*11.00*	11.13	3.80
4.34	*4.20*	64.52	*60.00*	8.80	*11.00*	9.58	3·82
4.07	*4.20*	63.17	*60.00*	10.55	*11.00*	9.83	3.79

CORN AND

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Quaker Oats Co.,	2	1474	8.81	*8.00*
Cedar Rapids, Iowa.	4	1627	8.94	*8.00*
Banner Feed.	3	1908	9.31	*8.00*
	1	2148	8.98	*8.00*
Average	10		8.99	*8.00*
Schumacher Stock Feed.	1	1315	9.44	*11.00*
	3	1497	10.50	*11.00*
Average	4		9.97	*11.00*
Ralston Purina Co.,				
St. Louis, Mo.	1	1719	11.75	*11.20*
Cereola Cow Feed.	2	1836	12.00	*11.20*
Average	3		11.88	*11.20*
Good Luck Alfalfa Feed.	2	1646	11.69	*10.00*
Corn, Oats and Alfalfa.	2	1835	11.25	*10.00*
	2	1937	11.75	*10.00*
Average	6		11.57	*10.00*
Peerless Feed.	4	651	7.38	*7.40*
	2	730	8.00	*7.40*
	4	963	8.10	*7.40*
	11	1238	7.94	*7.40*
	6	1401	8.86	*7.40*
	8	1518	7.16	*7.40*
	9	1642	7.94	*7.40*
	6	1791	6.87	*7.40*
	7	1879	9.06	*7.40*
	5	2016	10.10	*7.40*
	1	2190	11.25	*7.40*
Average	63		8.42	*7.40*
Peerless Alfalfa Feed.	1	1584	10.25	*10.00*
Corn, Oats and Alfalfa.	1	1929	11.28	*10.00*
Average	2		10.76	*10.00*

OAT FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.14	*3.50*	64.34	*62.00*	9.88	*10.00*	10.74	3.09
3.28	*5.50*	66.48	*62.00*	9.36	*10.00*	8.92	3.02
3.28	*3.50*	62.82	*62.00*	11.43	*10.00*	9.88	3.28
3.35	*3.50*	65.29	*62.00*	9.36	*10.00*	10.34	2.78
3.26	*3.50*	64.73	*62.00*	10.01	*10.00*	9.97	3.04
2.66	*4.00*	62.79	*60.00*	11.14	*10.00*	10.25	3.72
3.08	*4.00*	61.79	*60.00*	10.80	*10.00*	10.22	3.61
2.87	*4.00*	62.29	*60.00*	10.97	*10.00*	10.23	3.67
2.85	*4.30*	51.08	*58.58*	18.36	*12.60*	9.01	6.95
2.33	*4.30*	50.98	*58.58*	18.57	*12.60*	9.62	6.50
2.59	*4.30*	51.03	*58.58*	18.46	*12.60*	9.31	6.73
3.36	*4.00*	58.18	*56.00*	13.96	*14.90*	7.77	5.04
3.47	*4.00*	58.85	*56.00*	11.60	*14.90*	10.04	4.78
3.33	*4.00*	56.68	*56.00*	12.48	*14.90*	10.85	4.91
3.39	*4.00*	57.90	*56.00*	12.68	*14.90*	9.55	4.91
2.44	*3.80*	59.24	*59.20*	13.70	*14.70*	11.23	6.01
3.54	*3.80*	60.61	*59.20*	14.35	*14.70*	8.46	5.04
3.08	*3.80*	54.54	*59.20*	16.97	*14.70*	10.79	6.52
3.17	*3.80*	56.04	*59.20*	15.82	*14.70*	9.98	7.05
3.20	*3.80*	54.34	*59.20*	14.82	*14.70*	11.93	6.85
3.00	*3.80*	52.49	*59.20*	18.80	*14.70*	10.84	7.71
3.31	*3.80*	59.93	*59.20*	14.39	*14.70*	8.10	6.33
2.67	*3.80*	56.14	*59.20*	17.62	*14.70*	9.12	7.58
3.30	*3.80*	54.06	*59.20*	16.05	*14.70*	10.55	6.98
3.80	*3.80*	56.25	*59.20*	14.08	*14.70*	8.95	6.82
3.38	*3.80*	57.25	*59.20*	12.25	*14.70*	10.22	5.65
3.17	*3.80*	56.45	*59.20*	15.35	*14.70*	10.02	6.59
3.60	*4.00*	60.27	*56.00*	11.88	*14.90*	9.56	4.40
3.33	*4.00*	55.85	*56.00*	13.45	*14.90*	11.58	4.51
3.48	*4.00*	58.06	*56.00*	12.67	*14.90*	10.57	4.46

CORN AND

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Ralston Purina Co., **St. Louis, Mo.** (Continued.) Protena Alfalfa Feed. Alfalfa, Corn and Oats.	3	993	9.63	*10.00*
	2	1282	9.88	*10.00*
	4	1359	10.69	*10.00*
	3	1671	10.13	*10.00*
	3	1811	10.46	*10.00*
	2	1943	11.06	*10.00*
	1	2063	10.81	*10.00*
	1	2193	10.06	*10.00*
Average	19		10.34	*10.00*
Purina Feed.	8	647	10.25	*9.00*
	5	693	10.31	*9.00*
	7	892	10.31	*9.00*
	2	1293	10.63	*9.00*
Average	22		10.38	*9.00*
Purina Feed, Fortified with Brewer's Grains.	9	1141	14.31	*14.00*
	6	1248	14.25	*14.00*
	20	1347	13.28	*14.00*
	5	1424	14.13	*14.00*
	13	1508	14.06	*14.00*
	31	1563	14.31	*14.00*
	17	1691	13.91	*14.00*
	1	1694	12.50	*14.00*
	14	1769	13.87	*14.00*
	17	1875	14.56	*14.00*
	1	1838	14.87	*14.00*
	6	2001	15.60	*14.00*
	5	2099	14.75	*14.00*
Average	125		14.18	*14.00*
Valley Milling Co., **St. Louis, Mo.** Chimo.	2	649	7.84	*7.50*
	3	1135	7.81	*7.50*
	10	1338	8.13	*7.50*
	6	1628	8.56	*7.50*
	2	1912	8.31	*7.50*
Average	23		8.13	*7.50*

OAT FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.72	*4.00*	59.87	*56.00*	11.90	*14.90*	9.85	5.03
3.50	*4.00*	56.31	*56.00*	14.72	*14.90*	9.48	6.11
2.99	*4.00*	54.81	*56.00*	15.35	*14.90*	10.50	5.66
3.26	*4.00*	58.02	*56.00*	13.08	*14.90*	10.71	4.80
2.90	*4.00*	57.75	*56.00*	13.77	*14.90*	9.72	5.40
3.38	*4.00*	55.81	*56.00*	13.95	*14.90*	11.43	4.37
3.50	*4.00*	57.76	*56.00*	12.02	*14.90*	11.55	4.36
3.74	*4.00*	62.26	*56.00*	9.18	*14.90*	11.28	3.48
3.37	*4.00*	57.82	*56.00*	13.00	*14.90*	10.57	4.90
3.73	*4.50*	58.52	*59.70*	12.37	*13.30*	10.84	4.29
4.50	*4.50*	59.60	*59.70*	12.34	*13.30*	8.62	4.63
4.18	*4.50*	58.32	*59.70*	12.10	*13.30*	10.52	4.57
4.06	*4.50*	61.10	*59.70*	11.42	*13.30*	8.76	4.03
4.11	*4.50*	59.39	*59.70*	12.05	*13.30*	9.69	4.38
5.48	*6.00*	59.73	*60.00*	8.33	*6.90*	9.21	2.94
5.08	*6.00*	59.94	*60.00*	7.37	*6.90*	10.20	3.16
4.82	*6.00*	59.80	*60.00*	7.53	*6.90*	11.20	3.37
4.71	*6.00*	55.97	*60.00*	9.56	*6.90*	11.65	3.98
4.42	*6.00*	59.27	*60.00*	8.51	*6.90*	9.98	3.76
4.92	*6.00*	57.32	*60.00*	8.34	*6.90*	11.33	3.78
4.67	*6.00*	59.52	*60.00*	8.82	*6.90*	9.68	3.40
4.39	*6.00*	61.58	*60.00*	8.30	*6.90*	9.48	3.75
6.33	*6.00*	57.54	*60.00*	8.15	*6.90*	9.83	4.28
4.75	*6.00*	57.90	*60.00*	8.60	*6.90*	10.83	3.36
5.13	*6.00*	59.09	*60.00*	9.23	*6.90*	8.05	3.63
4.75	*6.00*	56.82	*60.00*	9.00	*6.90*	9.95	3.88
4.42	*6.00*	56.52	*60.00*	8.92	*6.90*	11.58	3.81
4.91	*6.00*	58.54	*60.00*	8.54	*6.90*	10.21	3.62
3.73	*4.50*	60.27	*59.40*	13.44	*14.00*	10.36	4.36
4.35	*4.50*	59.95	*59.40*	12.73	*14.00*	10.99	4.17
4.44	*4.50*	60.97	*59.40*	12.54	*14.00*	9.65	4.27
4.23	*4.50*	61.22	*59.40*	13.11	*14.00*	8.71	4.17
3.33	*4.50*	61.24	*59.40*	12.25	*14.00*	10.58	4.29
4.01	*4.50*	60.73	*59.40*	12.82	*14.00*	10.06	4.25

CORN AND

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Valley Milling Co.,	5	648	7.81	*7.50*
St. Louis, Mo.	2	725	7.56	*7.50*
(Continued.)	10	863	7.94	*7.50*
	13	1105	8.38	*7.50*
Delta.	22	1240	8.31	*7.50*
	16	1343	7.94	*7.50*
	8	1436	7.94	*7.50*
	8	1507	7.63	*7.50*
	27	1560	8.44	*7.50*
	8	1693	8.19	*7.50*
	13	1776	8.21	*7.50*
	8	1884	7.75	*7.50*
	7	2015	7.94	*7.50*
	1	2159	8.44	*7.50*
Average	148		8.03	*7.50*
	1	674	6.50	*6.00*
	1	775	7.25	*6.00*
	2	1076	7.88	*6.00*
Mula Feed.	3	1322	8.31	*6.00*
	1	1972	8.25	*6.00*
Average	8		7.64	*6.00*
John Wade & Sons,				
Memphis, Tenn.	1	1604	9.81	*9.09*
Purity Feed.	1	2064	12.13	*9.09*
Average	2		10.97	*9.09*

HOMINY

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	% Found	% Guaranteed
American Hominy Co.,	1	794	10.69	*9.52*
Mt. Vernon, Ind.	2	1153	11.13	*9.52*
Homco Feed.	1	1540	10.19	*9.52*
	1	2147	11.13	*9.52*
Average	5		10.79	*9.52*
Hominy Feed.	2	1465	10.06	*8.34*
Atchison Live Stock Co., **Atchison, Kan.** **Hominy Feed or Germ Feed.**	1	779	9.93	*8.00*

OAT FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Guar-anteed	% Found	% Found
3.46	*4.50*	60.83	*59.40*	12.65	*14.00*	10.73	4.52
6.51	*4.50*	61.01	*59.40*	11.56	*14.00*	9.37	3.99
4.86	*4.50*	61.58	*59.40*	11.25	*14.00*	10,76	3.61
4.50	*4.50*	61.39	*59.40*	12.05	*14.00*	9.70	3.98
4.09	*4.50*	62.36	*59.40*	12.34	*14.00*	8.62	4.28
4.65	*4.50*	61.68	*59.40*	11.34	*14.00*	10.10	4 29
4.22	*4.50*	61.24	*59.40*	12.50	*14.00*	9.86	4.24
4.14	*4.50*	61.82	*59.40*	12.08	*14.00*	9.81	4.52
4.26	*4.50*	60.37	*59.40*	12.73	*14.00*	10.06	4.14
3.94	*4.50*	61.73	*59.40*	13.15	*14.00*	8.97	4.02
4.03	*4.50*	62.42	*59.40*	11.84	*14.00*	9.32	4.18
3.90	*4.50*	64.50	*59.40*	12.00	*14.00*	7 98	3.87
3.48	*4.50*	60.63	*59.40*	14.03	*14.00*	9.53	4.39
2.92	*4.50*	65.67	*59.40*	8.85	*14.00*	11.07	3.05
4.21	*4.50*	62.02	*59.40*	12.03	*14.00*	9.70	4.01
3.10	*4.00*	60.63	*51.00*	13.50	*17.00*	10.71	5.56
3.37	*4.00*	59.72	*51.00*	14.45	*17.00*	11.10	4.11
3.77	*4.00*	61.50	*51.00*	12.97	*17.00*	9.92	3.96
3.89	*4.00*	61.06	*51.00*	13.05	*17.00*	9.64	4.05
3 05	*4.00*	62 99	*51.00*	12.30	*17.00*	10.45	2.96
3.44	*4.00*	61.18	*51.00*	13.26	*17.00*	10.36	4.12
4.13	*4.15*	63.91	*60.56*	8.78	*8.89*	10.15	3.22
2.75	*4.15*	63.26	*60.56*	7.44	*8.89*	10.98	3.44
3.44	*4.15*	63.59	*60.56*	8.11	*8.89*	10.56	3.33

FEED.

8.16	*9.42*	65.88	*67.89*	3.35	*3.28*	9.27	2.65
8.78	*9.42*	65.30	*67.89*	3.28	*3.28*	8.62	2.89
8.57	*9.42*	65.19	*67.89*	3.91	*3.28*	9.36	2.78
8.31	*9.42*	64.09	*67.89*	4.81	*3.28*	8.81	2.85
8.45	*9.42*	65.11	*67.89*	3.84	*3.28*	9.02	2.79
8.17	*7.75*	65.34	*65.78*	4.15	*4.25*	9.64	2.64
7.39	*5.50*	63.31	*40.50*	5.44	*20.00*	10.98	2.95

HOMINY

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
T. H. Bunch & Co.,	2	1517	9.69	*8.70*
Little Rock, Ark.	3	1683	9.56	*8.70*
Hominy Feed.	5	1801	8.56	*8.70*
	2	1940	8.44	*8.70*
	1	2157	9.00	*8.70*
Average	13		9.05	*8.70*
Cumberland & Liberty Mills,	3	719	11.31	*10.50*
Nashville, Tenn.	1	901	11.81	*10.50*
Hominy Feed.	2	1198	11.31	*10.50*
Average	6		11.47	*10.50*
Plymouth Milling Co.,	6	931	10.50	*10.00*
Le Mars, Iowa.	6	1138	10.69	*10.00*
Hominy Feed.	2	1379	10.75	*10.00*
	1	1718	10.31	*10.00*
Average	15		10.56	*10.00*

FEED

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Blair Milling Co.,	2	1075	10.13	*9.62*
Atchison, Kan.	1	1411	9.72	*9.62*
Blair's Feed Meal.				
Average	3		9.92	*9.62*
B. F. Glover & Son Commission Co.,	1	793	12.62	*10.10*
New Orleans, La.	5	1231	9.78	*10.10*
N. B. Cow Feed.	3	1366	10.03	*10.10*
Corn Meal and Rice Polish.	3	1494	10.19	*10.10*
	4	1615	10.19	*10.10*
	3	1815	11.06	*10.10*
	6	1890	10.50	*10.10*
	5	2004	10.56	*10.10*
	2	2141	9.75	*10.10*
Average	32		10.52	*10.10*
New Orleans Milling Co.,	5	721	9.94	*9.13*
New Orleans, La.	5	859	9.44	*9.13*
Corn Feed Meal.	4	1246	11.25	*9.13*
	1	1960	10.19	*9.13*
	1	2066	10.13	*9.13*
Average	16		10.19	*9.13*

FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
7.63	7.25	62.00	65.75	7.90	8.08	10.36	2.42
7.32	7.25	66.56	65.75	5.62	8.08	8.48	2.46
6.85	7.25	65.01	65.75	8.98	8.08	8.37	2.23
6.48	7.25	62 70	65.75	10.35	8.08	10.00	2.06
6.87	7.25	63.27	65.75	9.49	8.08	9.18	2.09
7.03	7.25	63.91	65.75	8.29	8.08	9.27	2.45
9.11	10.00	60.63	50.00	4.53	6.81	11.35	3.07
8.65	10.00	61.33	50.00	5.81	6.81	9.67	2.73
8.79	10.00	61.94	50.00	5.22	6.81	9.43	3.31
8.85	10.00	61.30	50 00	5.19	6.81	10.15	3.04
7 92	8.80	64.19	61.00	4.64	6.35	10.12	2.63
8.58	8.80	62.79	61.00	4.84	6.35	10.34	2.76
8.11	8.80	62.89	61.00	4.80	6.35	10.83	2.62
8.12	8.80	64.76	61.00	4.93	6.35	9.33	2.55
8.18	8.80	63.66	61.00	4.80	6.35	10.16	2.64

MEAL.

6.83	6.85	67.01	60.25	3.81	5.38	9.67	2.55
7.96	6.85	63,59	60.25	5.04	5.38	11.05	2.64
7.40	6.85	65.30	60.25	4.42	5.38	10.36	2.60
6.41	6.90	63.89	64.26	3.91	6.60	9.98	3.19
3.79	6.90	73.18	64.26	1.55	6.60	10.11	1.59
3.70	6.90	71.20	64.26	2.27	6.60	11.14	1.66
3.07	6.90	72.10	64.26	2.29	6.60	10.81	1.54
2.64	6.90	74.62	64.26	1.73	6.60	9.65	1.17
3.40	6.90	71.81	64.26	3.19	6.60	9.41	1.13
3.68	6.90	69.54	64.26	4.05	6.60	10.48	1.75
2.60	6.90	73.36	64.26	1.85	6.60	9.90	1.73
2.72	6.90	73.14	64.26	1.93	6.60	10.85	1.61
3.55	6.90	71.43	64.26	2.53	6.60	10.26	1.71
7.40	7.37	65.78	67.60	5.24	7.37	9.05	2.59
6.74	7.37	65.25	67.60	5.21	7.37	11.12	2.24
6.26	7.37	67.11	67.60	3.54	7.37	9.61	2.23
7.45	7.37	65.07	67.60	6.43	7.37	8.50	2.36
6.17	7.37	66.27	67.60	5.11	7.37	10 14	2.18
6.80	7.37	65.90	67.60	5.11	7.37	9.68	2.32

FEED

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Yates & Donelson Co., **Memphis, Tenn.** Feed Meal.	4	806	10.69	*10.10*
	2	969	11.31	*10.10*
	5	1295	11.13	*10.10*
	3	1916	10.75	*10.10*
Average	14		10.97	*10.10*

BREWERS'

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
Anheuser Busch Brewing Association, **St. Louis, Mo.** Dried Brewers' Grain.	1	1375	22.19	*24.00*
Atlas Feed Products & Milling Co., **New Orleans, La.** Brewers' Grain.	2	644	25.00	*22.00*
	1	797	20.04	*22.00*
Average	3		22.52	*22.00*
Houston Ice & Brewing Co., **Houston, Texas.** Dried Brewers' Grain.	2	769	25.19	*23.19*
	2	1222	26.44	*23.19*
	2	1525	26.31	*23.19*
Average	6		25.98	*23.19*
R. H. Polack, **New Orleans, La.** Dried Brewers' Grain.	1	677	20.03	*23.81*
	2	752	19.31	*23.81*
	2	881	25.13	*23.81*
	6	1039	25.88	*23.81*
	7	1342	28.44	*23.81*
	6	1512	24.00	*23.81*
	3	1680	24.69	*23.81*
	2	1837	23.10	*23.81*
	2	1932	22.00	*23.81*
	3	2035	26.00	*23.81*
	2	2121	26.56	*23.81*
Average	36		24.11	*23.81*

POULTRY

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
American Milling Co., **Owensboro, Ky.** Sucrene Poultry Feed.	1	1729	16.87	*17.50*
	1	2192	17.13	*17.50*
Average	2		17.00	*17.50*

MEAL.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
7.14	*6.90*	63.65	*64.25*	5.61	*6.60*	10.54	2.37
6.88	*6.90*	64.15	*64.25*	4.88	*6.60*	10.42	2.36
7.84	*6.90*	64.18	*64.25*	6.13	*6.60*	8.25	2.47
6.80	*6.90*	64.23	*64.25*	6.75	*6.60*	8.95	2.52
7.17	*6.90*	64.05	*64.25*	5.84	*6.60*	9.54	2.43

GRAIN

6.63	*7.50*	44.47	*45.00*	14.57	*12.00*	8.52	3.62
5.90	*7.00*	40.09	*45.00*	15.43	*11.00*	9.33	4.25
6.17	*7.00*	45.04	*45.00*	17.31	*11.00*	7.88	3.56
6.03	*7.00*	42.56	*45.00*	16.37	*11.00*	8.61	3.91
6.65	*7.25*	43.57	*42.79*	13.69	*14.10*	7.53	3.37
6.34	*7.25*	41.97	*42.79*	13.62	*14.10*	8.13	3.50
5.78	*7.25*	42.33	*42.79*	12.94	*14.10*	9.37	3.27
6.25	*7.25*	42.62	*42.79*	13.41	*14.10*	8.34	3.38
6.30	*7.02*	42.02	*37.63*	17.90	*16.77*	9.54	4.21
6.67	*7.02*	45.52	*37.63*	16.02	*16.77*	8.51	3.97
7.31	*7.02*	39.54	*37.63*	14.47	*16.77*	9.73	3.82
7.37	*7.02*	41.03	*37.63*	14.20	*16.77*	7.73	3.79
6.95	*7.02*	38.31	*37.63*	13.18	*16.77*	9.56	3.56
6.68	*7.02*	41.70	*37.63*	14.71	*16.77*	9.80	3.11
6.30	*7.02*	41.45	*37.63*	15.87	*16.77*	7.86	3.83
6.55	*7.02*	41.00	*37.63*	16.22	*16.77*	8.83	4.30
6.24	*7.02*	43 06	*37.63*	16.40	*16.77*	8.58	3.72
6.93	*7.02*	39.74	*37.63*	14.67	*16.77*	8.80	3.86
7.01	*7.02*	39.06	*37.63*	13.90	*16.77*	9.61	3.86
6.76	*7.02*	41.13	*37.63*	15.23	*16.77*	8.96	3.82

FEED

6.77	*5.50*	49.77	*50.00*	9.72	*12.00*	10.59	6.28
5.65	*5.50*	50.83	*50.00*	9.93	*12.00*	10.69	5.77
6.21	*5.50*	50.30	*50.00*	9.83	*12.00*	10.64	6.02

POULTRY

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein % Found	Protein % Guaranteed
W. F. Chamberlain,	2	1939	9.38	*11.00*
St. Louis, Mo.	1	2183	12.63	*11.00*
Chamberlain Hen Feed.				
Average	3		11.01	*11.00*
Pigeon Feed.	1	1982	11.44	*12.00*
	1	2182	12.06	*12.00*
Average	2		11.75	*12.00*
Corno Mills Co.,				
East St. Louis, Ill.	7	1171	10.75	*10.00*
	3	1354	10.38	*10.00*
	4	1502	9.75	*10.00*
	4	1653	10.88	*10.00*
	3	1833	10.62	*10.00*
Corno Chick Feed.	2	1944	10.75	*10.00*
	1	2191	10.56	*10.00*
Average	24		10.53	*10.00*
	3	786	9.38	*10.00*
	5	929	11.50	*10.00*
	5	1102	11.75	*10.00*
	7	1170	10.19	*10.00*
	4	1294	10.69	*10.00*
	5	1503	10.38	*10.00*
Corno Hen Feed.	5	1598	10.63	*10.00*
	2	1702	9.53	*10.00*
	5	1793	10.00	*10.00*
	5	1895	10.31	*10.00*
	2	2052	10.69	*10.00*
	2	2113	10.69	*10.00*
Average	50		10.48	*10.00*
Darling & Co.,	2	980	61.44	*55.65*
Chicago, Ill.	1	1530	62.37	*55.65*
Beef Scraps.	2	1750	66.37	*55.65*
	2	2140	56.13	*55.65*
Average	7		61.58	*55.65*
Darling's Chick Food.	1	1958	10.56	*8.00*

FEED

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.44	5.00	65.98	30.00	3.14	9.00	9.73	8.33
3.93	5.00	62.64	30.00	5.75	9.00	9.62	5.43
3.69	5.00	64.31	30.00	4.44	9.00	9.67	6.88
3.90	5.00	65.93	30.00	3.26	8.00	11.10	4.37
3.12	5.00	66.18	30.00	2.73	8.00	10.70	5.21
3.51	5.00	66.06	30.00	2.99	8.00	10.90	4.79
2.85	3.50	69.42	70.00	3.52	3.40	11.40	2.06
2.84	3.50	69.49	70.00	3.52	3.40	11.71	2.06
2.65	3.50	70.94	70.00	3.71	3.40	10.96	1.99
2.78	3.50	72.02	70.00	3.03	3.40	9.45	1.84
3.07	3.50	70.57	70.00	3.19	3.40	10.45	2.10
2.68	3.50	69.34	70.00	3.58	8.40	11.58	2.07
3.04	3.50	71.56	70.00	2.20	3.40	11.05	1.59
2.84	3.50	70.48	70.00	3.25	3.40	10.94	1.96
3.24	3.70	70.30	70.00	2.60	2.30	12.80	1.68
3.71	3.70	69.71	70.00	2.68	2.30	10.72	1.68
2.42	3.70	70.51	70.00	2.31	2.30	11.40	1.61
3.03	3.70	70.70	70.00	2.40	2.30	12.04	1.64
3.02	3.70	71.51	70.00	2.37	2.30	10.81	1.60
3.31	3.70	70.85	70.00	2.71	2.30	11.20	1.55
2.92	3.70	72.89	70.00	2.29	2.30	9.79	1.48
3.25	3.70	72.25	70.00	2.61	2.30	10.78	1.58
2.86	3.70	72.63	70.00	2.33	2.30	10.53	1.65
2.98	3.70	72.62	70.00	2.40	2.30	10.20	1.49
2.87	3.70	71.20	70.00	2.43	2.30	11.27	1.54
3.60	3.70	70.05	70.00	2.90	2.30	11.20	1.56
3.10	3.70	71.27	70.00	2.50	2.30	11.06	1.59
10.92	10.15	....	....	....	....	....	....
11.14	10.15	....	....	....	....	....	....
9.80	10.15	....	....	....	....	....	....
14.70	10.15	....	....	....	....	....	....
11.64	10.15	....	....	....	....	....	....
2.50	1.00	57.23	40.00	4.25	12.00	8.58	16.88

POULTRY

Name of Manufacturer of Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed.
Haspel & Davis, **New Orleans, La.** Rice Chicken Feed.	1	1011	8.19	*5.00*
B. F. Glover & Sons Com. Co., **New Orleans, La.** N. B. Chicken Feed. Sweepings, Corn and Oats.	1	788	5.50	*5.00*
	6	1307	9.44	*5.00*
	4	1469	8.69	*5.00*
	3	1664	10.25	*5.00*
	2	1834	10.62	*5.00*
	4	1898	10.63	*5.00*
	3	2033	11.78	*5.00*
	1	2139	10.44	*5.00*
Average	22		9.67	*5.00*
Model Milling Co., **Buffalo, N. Y.** Model Growing Food. Cracked Corn, Peas and Seeds.	2	1447	12.00	*12.40*
Model Nursery Chick Food.	1	1585	11.50	*11.86*
People's Independent Rice Mill Co., Ltd., **Crowley, La.** Chicken Feed. Rice Grits, Sweepings, Weed Seeds.	3	1579	8.25	*9.12*
	2	1832	7.84	*9.12*
Average	5		8.05	*9.12*
Ralston Purina Co., **St. Louis, Mo.** Purina Mill Feed, Chick Size.	4	985	11.31	*11.00*
	6	1173	11.19	*11.00*
	5	1253	11.50	*11.00*
	6	1334	11.31	*11.00*
	10	1506	11.06	*11.00*
	13	1633	11.63	*11.00*
	7	1773	11.25	*11.00*
	4	1894	11.69	*11.00*
	1	2185	12.00	*11.00*
Average	56		11.44	*11.00*

FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.07	*0.50*	63.33	*50.00*	7.23	*35.00*	10.79	7.39
3.62	*2.00*	69.83	*70.00*	5.35	*30.00*	11.50	4.20
3.71	*2.00*	66.87	*70.00*	7.06	*30.00*	8.87	4.05
3.68	*2.00*	67.95	*70.00*	5.95	*30.00*	10.91	2.82
3.53	*2.00*	65.84	*70.00*	6.27	*30.00*	9.99	4.12
3.30	*2.00*	67.02	*70.00*	5.45	*30.00*	10.08	3.53
3.25	*2.00*	64.68	*70.00*	7.85	*30.00*	9.30	4.29
3.15	*2.00*	60.61	*70.00*	8.55	*30.00*	10.95	4.96
3.60	*2.00*	66.21	*70.00*	5.78	*30.00*	9.64	4.33
3.48	*2.00*	66.13	*70.00*	6.53	*30.00*	10.15	4.04
2.78	*2.18*	68.42	*80.27*	2.12	*2.48*	12.95	1.73
3.18	*2.93*	69.24	*76.94*	2.94	*3.33*	11.17	1.97
1.75	*3.00*	52.80	*53.94*	8.86	*7.14*	9.40	18.94
2.76	*3.00*	55.36	*53.94*	9.99	*7.14*	8.97	15.08
2.25	*3.00*	54.08	*53.94*	9.42	*7.14*	9.19	17.01
4.02	*3.60*	67.02	*65.00*	3.80	*4.00*	11.44	2.41
3.49	*3.60*	68.57	*65.00*	3.43	*4.00*	11.73	2.09
3.46	*3.60*	69.60	*65.00*	2.95	*4.00*	10.46	2.03
3.55	*3.60*	68.78	*65.00*	3.32	*4.00*	11.04	2.00
3.46	*3.60*	70.32	*65.00*	3.43	*4.00*	9.60	2.13
3.54	*3.60*	69.47	*65.00*	3.30	*4.00*	10.15	1.91
3.80	*3.60*	69.05	*65.00*	3.68	*4.00*	10.09	2.13
4.48	*3.60*	69.13	*65.00*	3.43	*4.00*	9.28	1.99
4.77	*3.60*	67.04	*65.00*	3.59	*4.00*	10.28	2.32
3.84	*3.60*	68.78	*65.00*	3.43	*4.00*	10.40	2.11

POULTRY

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Ralston Purina Co.,	10	1162	10.69	*11.00*
St. Louis, Mo.	6	1255	10·50	*11.00*
(Continued.)	6	1335	10·81	*11.00*
	9	1441	11.06	*11.00*
	11	1580	11.25	*11.00*
Purina Mill Feed, Scratch Size.	5	1692	10.69	*11.00*
	8	1772	11.00	*11.00*
	6	1892	11.31	*11.00*
	1	2069	11.63	*11.00*
Average	62		10.99	*11.00*
	2	1095	17.13	*17.00*
	3	1298	16.94	*17.00*
Purina Mash.	2	1521	16.56	*17.00*
Ground Alfalfa, Corn Bran and Weed Seeds.	2	1649	15.53	*17.00*
	2	1851	16.31	*17.00*
	1	1985	16.69	*17.00*
Average	12		16.53	*17.00*
Purina Pigeon Feed.	2	1906	12.63	*11.00*
Steinmesch F. & P. S. Co.,	1	843	15.75	*14.10*
St. Louis, Mo.	1	1697	14.25	*14.10*
Steinmesch Early Breakfast Mash.	1	1841	14.00	*14.10*
Average	3		14.67	*14.10*
Steinmesch Extra Quality Chick Feed.	2	827	12.06	*12.60*
	2	1281	11.81	*12.60*
	3	1420	10.69	*12.60*
	1	1751	12.65	*12.60*
Average	8		11.81	*12.60*
Steinmesch Select Hen Feed.	4	947	11.44	*11.00*
	3	1358	11.31	*11.00*
	4	805	11.19	*11.00*
	2	1678	11.56	*11.00*
	1	1971	12.72	*11.00*
	2	2050	11.54	*11.00*
	1	2184	10.88	*11.00*
Average	17		11.52	*11.00*
Steinmesch Select Pigeon Feed.	1	841	12.37	*12.00*
	1	1583	11.38	*12.00*
	1	1966	11.50	*12.00*
Average	3		11.75	*12.00*

FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Guaranteed	% Found	% Found
3.07	3.60	69.86	65.00	3.24	4.00	11.26	1.88
3.27	3.60	69.77	65.00	3.74	4.00	10.76	1.96
3.25	3.60	69.86	65.00	3.33	4.00	10.90	1.85
2.91	3.60	68.30	65.00	3.47	4.00	12.30	1.96
2.83	3.60	69.27	65.00	3.56	4.00	10.80	2.29
2.76	3.60	71.69	65.00	3.09	4.00	10.11	1.66
3.17	3.60	70.40	65.00	3.42	4.00	10.13	1.88
3.15	3.60	69.15	65.00	3.63	4.00	11.03	1.73
3.96	3.60	67.31	65 00	3.88	4.00	11.23	1.99
3.15	3.60	69.52	65.00	3.48	4.00	10.95	1.91
2.93	5.00	51.91	44.00	10.93	11.50	11.58	5.52
2.76	5.00	58.15	44.00	9.41	11.50	7.53	5.21
2.42	5.00	53.89	44.00	10.53	11.50	11.19	5.41
2.61	5.00	55.78	44.00	11.65	11.50	9.60	4.83
2.84	5.00	55.76	44.00	11.65	11.50	7.71	5.73
2.80	5.00	54.61	44.00	9.78	11.50	10.98	5.14
2.73	5.00	55.01	44.00	10.66	11.50	9.76	5.31
2.65	3.60	68.86	65.00	3.35	4.00	10 68	1.83
4.05	3.00	47.25	40.00	11.19	8.00	9.09	12.67
3.07	3.00	53.00	40.00	10.85	8.00	9.88	8.95
4.18	3.00	51.41	40.00	12.68	8.00	8.58	9.15
3.77	3.00	50.55	40.00	11.57	8.00	9.18	10.26
6.78	3.10	56.33	30.00	5.75	9.00	9.57	9.51
4.36	3.10	58.61	30 00	6.47	9.00	9.17	9.58
3.20	3.10	61.23	30.00	5.34	9.00	10.63	8.91
5.73	3.10	53.98	30.00	6.22	9.00	8.79	12.63
5.02	3.10	57.53	30.00	5.94	9.00	9.54	10.16
3.53	3.00	65.29	30.00	4.24	9.00	10.69	4.81
2.85	3.00	62.27	30.00	3.92	9.00	10.55	9.10
3.79	3.00	60.18	30.00	4.94	9.00	9.80	10.10
3.16	3.00	67.05	30.00	3.94	9.00	9.78	4.51
5.00	3.00	62.54	30.00	6.25	9.00	9.70	3.79
4.02	3.00	60.24	30.00	4.77	9.00	10.13	9.30
3.12	3.00	63.33	30.00	4.92	9.00	10.03	7.72
3.64	3.00	62.98	30.00	4.71	9.00	10.10	7.05
3.53	3.60	63.31	30.00	5.00	9.00	10.78	5.01
3.27	3.60	61.99	30.00	5.51	9.00	9.73	8.12
3.88	3.60	67.23	30.00	4.43	9.00	9.30	3.66
3.56	3.60	64.17	30.00	4.98	9.00	9.94	5.60

POULTRY

Name of Manufacturer or Jobber and Brand	Number of Samples Composited	Station Number	Protein	
			% Found	% Guaranteed
Valley Milling Co., **St. Louis, Mo.** Acme Chicken Feed.	3	787	10.47	*6.50*
	4	940	7.62	*6.50*
	7	1169	9.69	*6.50*
	3	1242	9.44	*6.50*
Contains Shells.	4	1356	9.87	*6.50*
	6	1516	10.44	*6.50*
	5	1684	9.93	*6.50*
	3	1816	10.50	*6.50*
	1	1956	11.19	*6.50*
Average	36		9.91	*6.50*
Swift & Co., **Chicago Ill.** Swift's Beef Scraps.	1	1619	64.97	*55.00*
Swift's Blood Meal.	1	1620	83.86	*87.00*
Swift's Digester Tankage.	1	2149	57.13	*60.00*
Swift's Poultry Bone.	1	1621	26.75	*25.00*

MISCELLANEOUS

B. F. Glover & Son Commission Co. **New Orleans La.** N. B. Barley and White Oats.	3	1472	11.27	*12.25*
	7	1551	11.50	*12.25*
N. B. Barley and Mixed Oats.	1	1869	11.44	*12.25*
Average	8		11.47	*12.25*
Moore Grocery Co. **Kansas City Mo.** Mixed Feed, Barley and Oats.	1	1218	11.06	*8.00*
Ralston Purina Co., **St. Louis, Mo.** Alfalfa Meal.	2	1376	12.66	*16.00*
	2	1519	20.69	*20.00*
Protena Dairy Feed. Alfalfa, Corn, Cotton Seed Meal and Wheat Products.	1	1727	21.37	*20.00*
Average	3		21.03	*20.00*
Davis & Andrews, **Memphis, Tenn.** Corn Bran.	1	1700	10.56	*7.00*

FEED.

Fat		Carbohydrates		Fiber		Water	Ash
% Found	% Guar-anteed	% Foun	% Guar-anteed	% Found	% Guar-anteed.	% Found	% Found
2.92	*3.00*	64.82	*55.00*	3.18	*15.00*	9.19	9.42
3.01	*3.00*	67.54	*55.00*	3.37	*15.00*	9.60	8.86
3.16	*3.00*	59.43	*55.00*	3.18	*15.00*	9.84	14.70
2.79	*3.00*	60.15	*55.00*	3.34	*15.00*	9.31	14.97
2.96	*3.00*	60.31	*55.00*	4.11	*15.00*	10.00	12.75
2.79	*3.00*	58.50	*55.00*	3.97	*15.00*	9.69	14.61
2.82	*3.00*	63.69	*55.00*	2.57	*15.00*	8.70	12.29
3.59	*3.00*	63.22	*55.00*	2.61	*15.00*	9.43	10.65
3.45	*3.00*	66.42	*55.00*	3·25	*15.00*	10.50	5.19
3.06	*3.00*	62.68	*55.00*	3.28	*15.00*	9.58	11.49
9.79	*10.00*	....	....	....	....	....	....
....	....	....	....	....	....	....	....
13.56	*6.00*	....	....	....	....	....	....
....	....	....	....	....	....	....	....

FEED.

3.90	*3.00*	61.52	*61.17*	9.37	*10.00*	10.56	3.38
4.11	*4.25*	61.97	*59.57*	8.92	*9.25*	10.28	3.22
3.95	*4.25*	61.45	*59.57*	10.95	*9.25*	8.55	3.66
4.03	*4.25*	61.71	*59.57*	9.94	*9.25*	9.41	3.44
4.48	*3.00*	62.24	*40.00*	9.49	*15.00*	9.27	3.46
1.66	*2 00*	35.39	*35.00*	31.20	*29.50*	11.00	8.09
5.53	*3.50*	40.75	*48.00*	16.79	*16.00*	10.50	5.74
6.03	*3.50*	39.71	*48.00*	17.01	*16.00*	10.00	5.88
5.78	*3.50*	40.23	*48.00*	16.90	*16.00*	10.25	5.81
6.77	*4.96*	61.26	*55.04*	9.45	*13.35*	9.68	2.28

Bulletin No. 99. December 1907.

Agricultural Experiment Station

OF THE

Louisiana State University
and A. & M. College,

BATON ROUGE.

Japanese Persimmons

F. H. BURNETTE

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and A. and M. College.

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Japanese Persimmons.

F. H. Burnette.

For a number of years Japanese persimmons have been grown throughout the Southern States. For eighteen years a number of varieties have been grown at the State Experiment Station. Nearly all of the varieties grown have fruited, and although there is great confusion concerning their names, enough has been learned concerning some of the well-established varieties, to publish this brief statement of their growth and productiveness.

The Japanese persimmons were introduced into this country by the United States Department of Agriculture, largely through the efforts of Prof. H. E. Van Deman, while he was in charge of the pomological work of that department. They were grown in various sections, but it was soon found that they would not thrive well very far north of the 36th degree of latitude, hence they have been grown to some extent, more as a curiosity or novelty than as a commercial product. A zero temperature is very injurious to them—in many cases fatal.

In Louisiana they have been grown for a number of years. but not as an orchard fruit. The great abundance of the native persimmons which can be obtained so easily, and the natural taste which prevails for the native product also—have tended to prevent any widespread interest in the culture of the Japanese persimmon. In Japan, as a fruit, they have the same standing that apples possess in the Northern United States, hence are of great economic importance. They are grown in great abundance, and are put to many and varied uses. The Japanese methods of treatment to correct the astringent qualities of the unripe fruit are not fully understood in America, but investigations now in progress will determine the steps that are necessary to accomplish this object, and one of the greatest drawbacks to the growing of the fruit will thus be eliminated.

Being so very prolific, easily grown, and having such excellent qualities for transportation, there should be nothing to hinder the extension of their culture, for the Northern markets as well as for local consumption.

It is confidently believed, that easy and successful treatment will be brought out, that will correct the astringency of the fruit before softening, and thus present a fruit that is healthy and luscious and capable of being put to a large number of uses.

CONSIDERED BOTANICALLY.

There are a large number of species in the genus to which the persimmon belongs, but only two are mentioned as of any economic importance, native to America, and two likewise native of the Orient. These are:

Diospyros Virginiana—The native wild persimmon of the Southern States.

Diospyros Texana—Wild persimmon of Texas.

Diospyros kaki—Japanese persimmon.

Diospyros Lotus—Chinese persimmon.

Everyone in Louisiana is thoroughly acquainted with the native persimmon, and as this bulletin has to deal with the foreign species, nothing especially will be said concerning the native, unless it is to mention that they are very much neglected, and unfortunately so, as there is no doubt but that they are capable of being greatly improved by selection, cultivation and crossing. A fruit that varies naturally so much in size and quality, some day will be taken more vigorously in hand and numerous valuable varieties secured and perpetuated. There are at present about twenty varieties of our native persimmons cultivated locally in various parts of the United States.

The two foreign species mentioned have been growing at the Louisiana Station for several years, the *kaki* so far being the one of value.

Specimens of *Diospyros Lotus* (?) were sent to the Station by the United States Department of Agriculture in 1897. Only one tree proved to be pistillate. These trees were grown from seeds obtained by the United States Department of Agriculture at Niu Chuang, China.

It fills the description given for *Diospyros Lotus,* differing slightly in growth, as the trees at the Station are fairly vigorous and upright growers. It is therefore mentioned here as belonging to *Diospyros Lotus.* It is said to be hardier than *kaki,* and used as a stock for it in Japan. The fruit is very small (see cut No. 1), quite black, and of no value. It has not been used as stock at the Station.

Ordinarily, the Japanese persimmon does not grow to be a large tree. Occasionally, however, a good sized tree may be seen. Being such abundant bearers, the drain upon the tree serves to curtail the growth, and some of the varieties are little better than dwarfs. The complaints of short life of the trees, and the tendency to become dwarflike are no doubt due to over-productiveness.

The leaves of the *kaki* vary much in size and are much larger and heavier than those of our native species. The foliage is generally a dark myrtle green, and gives the tree value as an ornamental. The varieties differ as to their ability to throw off leaf diseases, some of them being very resistant. The flowers appear on the new growth and are very numerous, usually in ency, flavor and texture. Some are flat, others long, others usually they tend to bear not only to the limit of the strength of the tree, but very often overtaxing the tree.

The fruit varies in size, color, earliness of maturity, astringency, flavor and texture. Some are flat, others long, others round. Some are yellow fleshed, others orange, others tending to dark red with brown streaks. Some are edible when yet green, others are slightly astringent, others very astringent. Some ripen early in September, while others will hang on the tree almost to January. No fruit is more variable in all of these points, and up to the present there has been no classification of the fruit that is perfectly satisfactory.

METHODS OF PROPAGATION.

The universal practice in the propagation of Japanese persimmons now, is to use seedlings of our native species for stock. At first they were grown on their own roots, but the abundance of native, hardy stock was taken advantage of, and is now used. It is said that in Japan, the Chinese persimmon is often used, being hardier than the Japanese. The Japanese persimmons work readily upon our native stock, and as the latter is so abundant, hardy and rapid in growth, it leaves little to be desired as a stock.

The common method of propagation is to whip graft upon the whole root, about two inches below the surface of the ground. This is practically the only method used on a large commercial scale in persimmon nurseries. This is done very early in the season before growth starts, usually in January, sometimes later. Some growers do not wax the graft, only using common twine to tie, in order to hold the parts in close contact, and adjustment, the twine decaying by the time that a union is established. In fact, any method of underground grafting may be used with success.

The persimmons do not take very kindly to methods of budding. It is true that some propagators bud and are quite successful with them, but it requires every care and attention, with mank risks to run and dangers to overcome. Ring budding, performed late in summer—usually about August—is the method employed. It may be said also that this method in early spring has been tried by some growers. There is no doubt, however, but that root grafting is the most desirable from many standpoints, chief among them being the fact that if anything happens to the young tree through accident or otherwise, the variety is usually saved by a sprout coming from the base of the young tree above the point of union.

If anything happens to a young budded tree, the chances are that the value of the tree is lost by the losing of the bud An accident is very apt to happen with unreliable labor or from farm animals. Seeds of the native persimmon are obtained and sown in nursery rows. The seedlings are worked generally the second year, or if large enough, one year from seed. This depends entirely upon the size of the seedling. The aim is to secure a vigorous seedling, work it, and one year from the time of root grafting, have a young tree suitable to move from the nursery row to the place of permanent growth.

CARE.

Plenty of room should always be given, usually twenty or twenty-five feet apart.

There are a few points in the care of the Japanese persimmon tree that need emphasizing. They should be set young, and great care should be exercised that the setting be given the closest attention. Being a pronounced tap-rooted plant, the necessity of great care in setting is apparent. The roots should never be allowed to become exposed to the air and sun, and in setting, the mellow moist earth should be well firmed around them. Too much emphasis cannot be placed upon the need of setting young trees, and not resetting them, unless the necessity for doing so is beyond adjusting. Occasionally inquiries come to the Station concerning the transplanting of persimmon trees after several years' growth. While this may be done, it is certainly accomplished only by the greatest risk to the tree.

Good clean culture is all that is required, the same that is given in any well-cared for fruit orchard. In our heavy lands, or on soils similar in character to the soils of the bluff lands of Louisiana, sodding over should never be allowed, if good crops are desired. Any good complete manure may be used. A good crop of cow peas turned under every two or three years will be highly beneficial. No experiments have been undertaken to find out the exact fertilizer requirements, but it is believed a well-balancd fertilizer, suitable for orchard purposes, should be the one used. The Station orchard has received no commercial fertilizers, the only treatment has been the turning under of occasional crops of cow peas, and a light coating of autumn leaves removed from the University campus. No other dressings have been used.

During the first three years the growth of the tree should be watched, in order to build a symmetrical, upright tree.

This is not easy, for some of the varieties spread too much, and the leading upright branches are often overloaded and become broken easily, or are headed back by careless removal of fruit. Ordinarily, after they begin to bear, there is little need of pruning. The tendency to overbear is so strong, that new wood is not produced in abundance, and the tree becomes dwarf-like. Systematic thinning of the fruit is necessary to control this, as it will not do to leave the thinning to natural causes, and depend upon the tree to throw off all the fruit that it can not well take care of. The weakened condition from overbearing results in a sickly tree which readily becomes an easy prey to diseases and insects, and it requires a careful observer to train his tree and thin the fruit to the proper amount.

VARIETIES.

There has always been a great deal of confusion concerning the names of the Japanese persimmons, and it may be that some of these listed in this bulletin may be known under other names. Along with the varieties first obtained at the Station, was one known as *Among*. This is not listed in the catalogues now, the *Tsuru* bearing the same description that fits the *Among* that was sent to us.

This confusion of names is not to be wondered at, however, as the Japanese names are not easy to remember, spell or pronounce, and a great deal of trouble might have been saved by giving an American name.

The following is a list of varieties that have been grown at the Station:

COSTATA. (FIG 2.)

This is a fruit of medium size, slightly pointed, diameter varying from two to three inches, color of skin a light orange yellow, flesh also of light color. It is seedless (Fig. 3), strongly astringent until fully ripened, and keeps late. The tree is a good grower, prolific bearer, and makes a fine appearance in full fruit. Season, October 10th-November 10th.

HACHIYA.

This variety is very large and when in full fruit makes a striking appearance. Fruit is a reddish yellow, fine specimens measuring four inches in diameter and oblong; flesh, deep yellow, with occasional seeds. Also astringent until it softens. Season, September 20th-November 20th.

HYAKUME. (FIG 4.)

The *Hyakume* is also one of the largest of the Japanese persimmons. The tree is very prolific and shapely. Fruit approximately three inches in diameter and somewhat conical. Color of skin, light reddish yellow; flesh quite dark (Fig. 3) and seed-

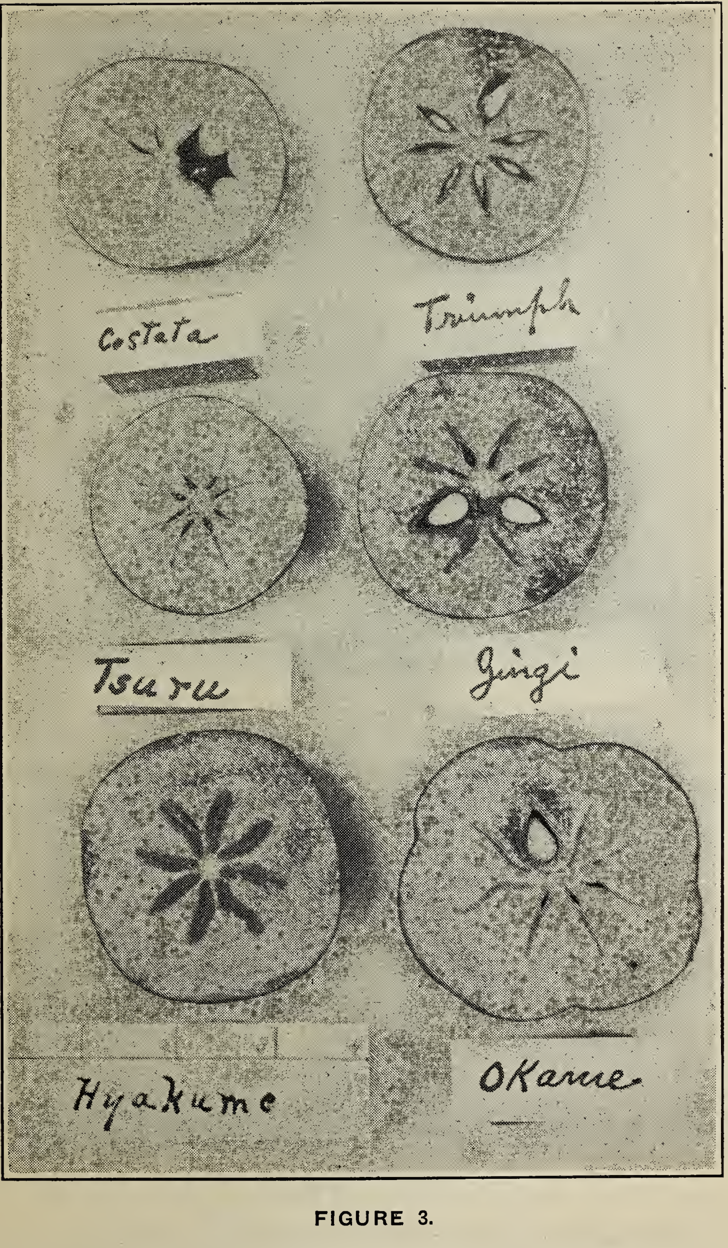
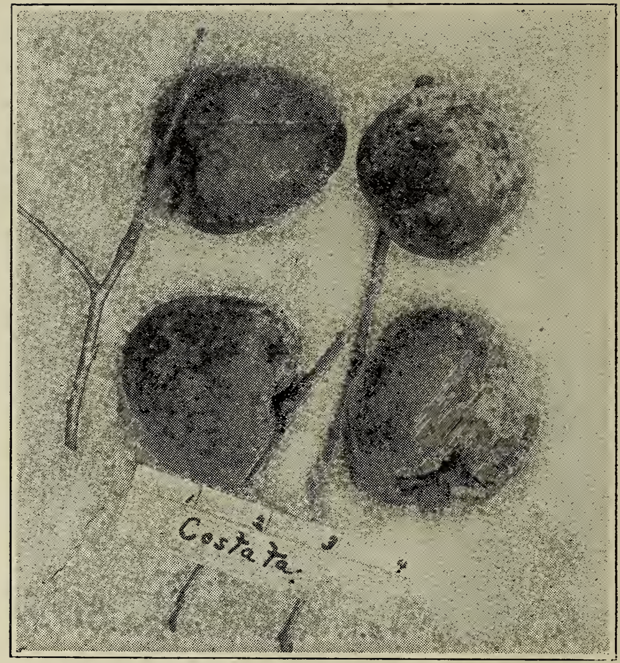


FIGURE 3.



COSTATA. (FIG. 2.)

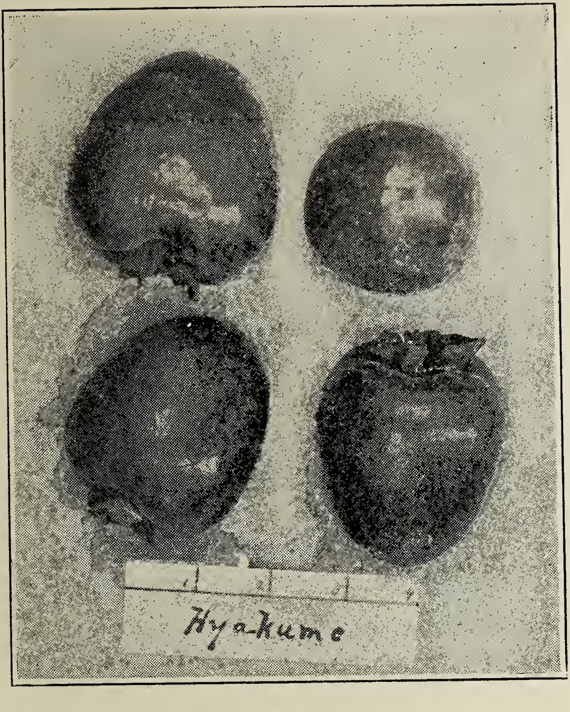
less. It loses its astringency early and has a good flavor. Some specimens may be pealed and eaten before softening. Season, October 15th-November 15th. A very desirable variety.

MYOTAN. (FIG. 5.)

This variety is not a strong grower, but is usually quite prolific. Fruit is nearly round and runs about two inches in diameter. Color is dark reddish yellow, and flesh is dark red with brown streaks, has numerous seeds, and is edible when hard. Has no astringency noticeable. May be pealed and eaten the same as an apple and has a pleasant flavor. Season, September 1st-October 15th.

NERO ZAMI.

This variety was one of the first planted in the grounds and



HYAKUME. (FIG. 4.)

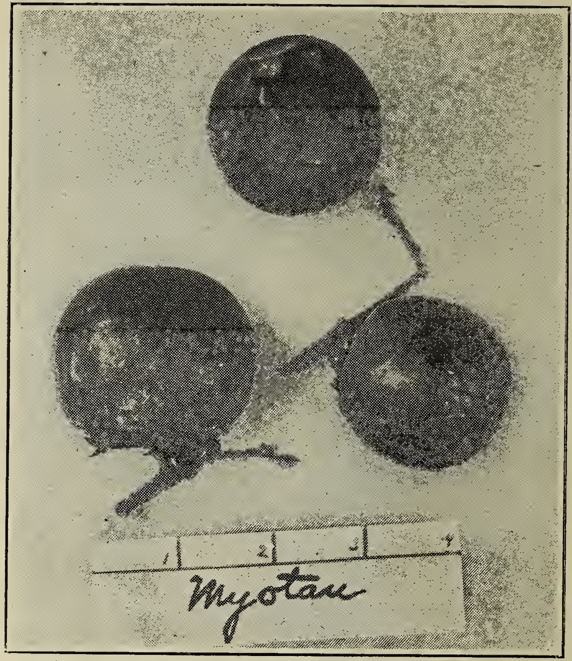
proved to be a weak grower. Fruit is small, nearly round, dark red in color, dark flesh and many seeds. It resembles the *Myotan* in size and appearance. Not prolific and not desirable. Season September 20th-October 20th.

OKAME. (FIG 6.)

This is a large tomato-shaped persimmon, usually three to three and one-quarter inches in diameter, flat and with quarters well marked. Tree a vigorous grower and very prolific. Color of fruit is a dark orange red, and flesh is deep yellow, with only now and then a seed (Fig. 3). Astringent until ripe. Season, September 20th to November 1st.

TABER, NO. 23.

This is a seedling grown and sent out by G. L. Taber, Glen



MYOTAN. (FIG. 5.)

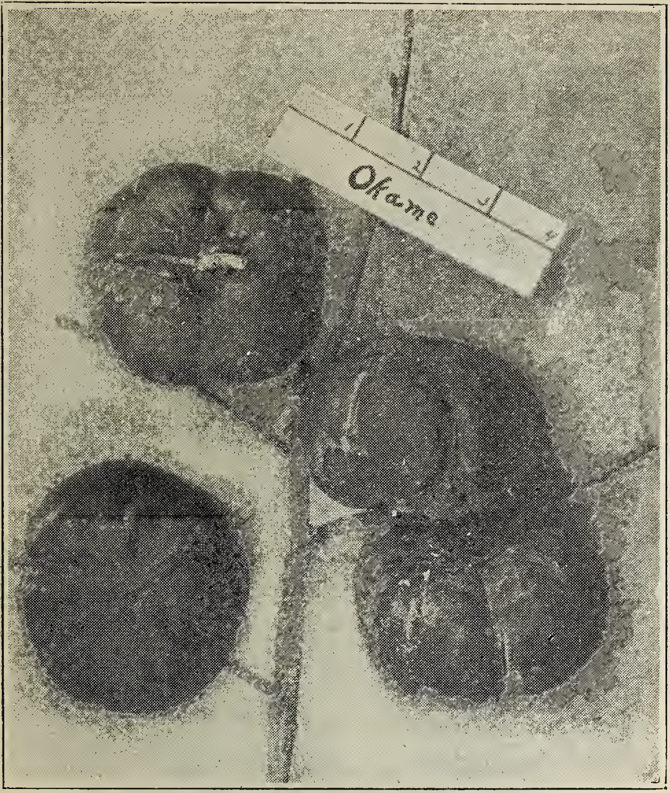
St. Mary, Florida. Color, dark red; flesh, dark, full of seeds and prolific. Not astringent. Season, September 15th to October 15th.

TABER. No. 129.

This is another seedling grown by G. L. Taber of Glen St. Mary, Florida. It is round and runs from two to three inches in diameter. It is dark in color, and the flesh is also dark and is edible when hard and immature. Season, September 15th to November 1st.

TANE NASHI. (FIG. 7.)

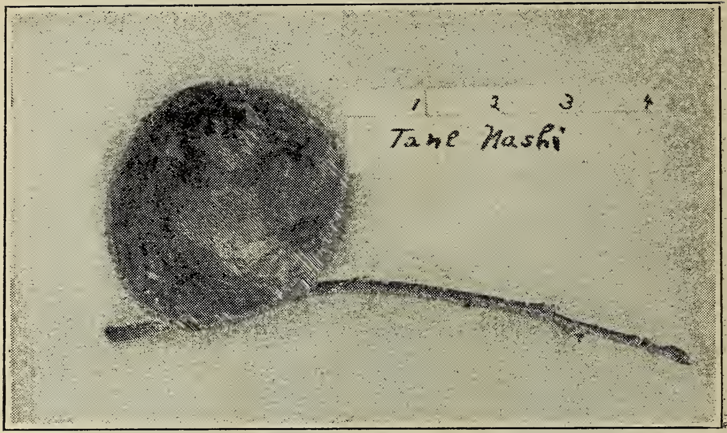
This is one of the large persimmons, nearly round, with a very small pointed tip, and about three and one-half inches in diameter. Color is a yellow red, bright and attractive; flesh also light in color, and seedless.



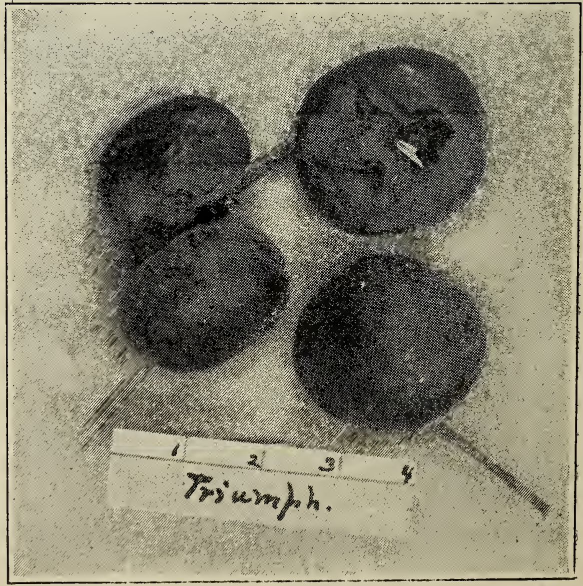
OKAME. (FIG. 6.)

TRIUMPH. (FIG. 8.)

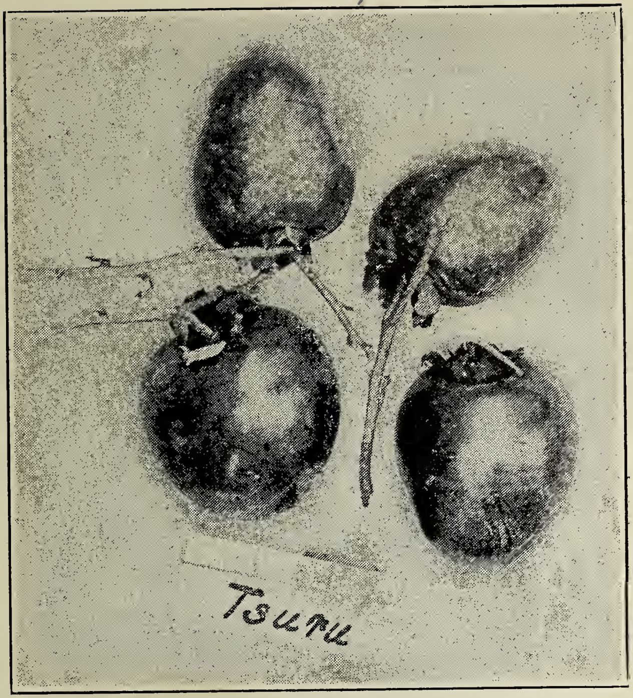
This variety came to the Station under the name of a seedling of the honey persimmon, and was identified as the Triumph by Prof. H. Harold Hume of Glen St. Mary, Florida. It is one of the most vigorous and healthy trees among the Japanese varieties, is upright in growth and has beautiful large myrtle green leaves, free from disease. The fruit is rather small and flat, about two and one-half inches in diameter and of a beautiful bright yellow red color. Flesh is yellow and has seeds. (Fig. 3.) Slightly astringent until softening. The most delicious of the Japanese varieties. Season, September 20th to November 20th.



TANE NASHI. (FIG. 7.



TRIUMPH. (FIG. 8.)



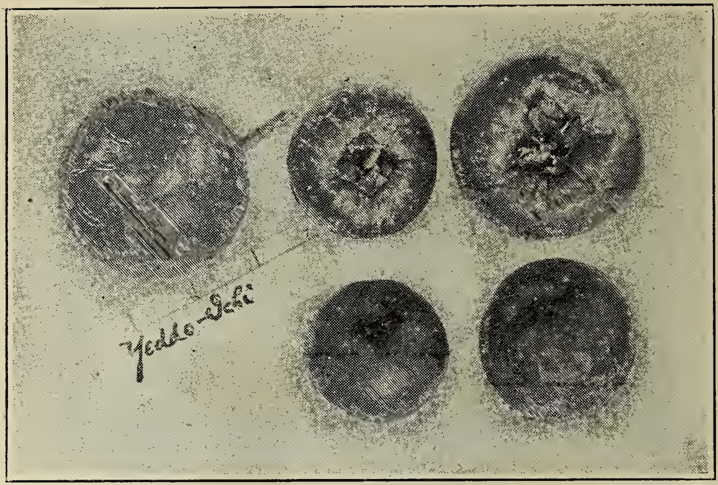
TSURU. (FIG. 9)

TSURU. (FIG. 9.)

While there may be some doubt that the figure shown under this name is the true *Tsuru,* but is believed that it is. It came to the Station as *Among,* but answers to the description given in the catalogues as *Tsuru.* It is long fruited, fully an inch longer than its diameter, which is about two and one-half inches. In color it is yellow red, and its flesh is on the same order. Most of the specimens are seedless. Very prolific. Season, October 1st to November 1st. (Fig. 3.)

YEDDO-ICHI. (FIG. 10.)

At the Station, this variety is medium in size and nearly round. It runs about two and one-half inches in diameter Color of skin dark, and flesh dark and brownish, and contains seeds. It is edible when hard, and has a very pleasant flavor.



YEDDO-ICHI. (FIG. 10.)

The tree is a good grower and is very prolific.

ZINGI. (FIG. 11.)

This is a very heavy bearing vigorous tree, and the fruit is nearly round, running about two and one-half inches in diameter. Color, medium red, and flesh darker with seeds. (Fig. 3.) Like the *Myotan,* it is edible when hard. Season, September 1st to October 1st.

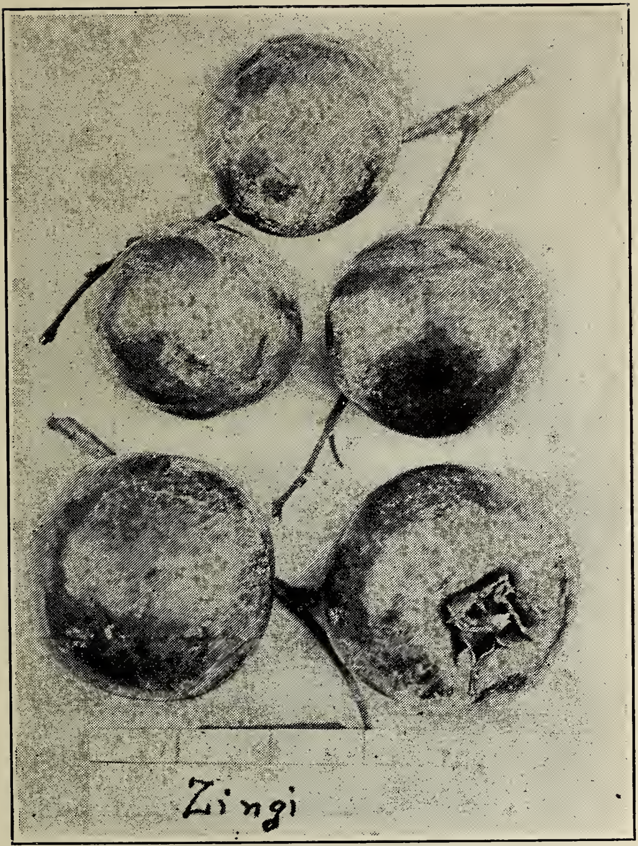
KORA KAMI.

The variety at the station under this name resembles the *Zingi* in many particulars, and possibly may be the same. The tree is not as vigorous or prolific as the *Zingi.* It was a weak grower and died after bearing three years.

SEEDLING. (FIG. 12.)

This variety was sent to us as a seedling. It is a very vigorous grower, with fruit nearly round, running from two and one-half to three inches in diameter, bright in color and flesh light, seedy and astringent. Season, September 10th to October 20th. Very prolific.

The persimmons shown in Figure 13 are various types of



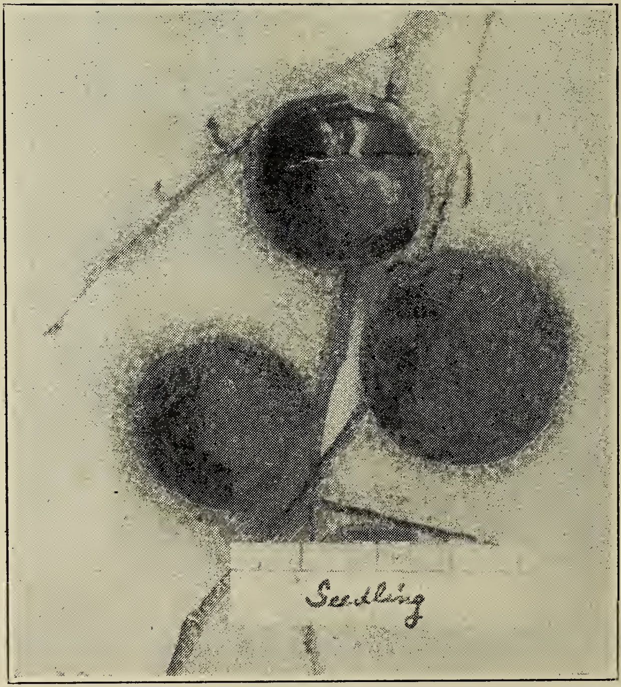
ZINGI. (FIG. 11.)

native persimmons, and are presented only to form a comparison of the native and foreign varieties.

In Figure 1 are shown specimens of *Diospyros Lotus,* the Chinese persimmon and the Honey, a variety of our American species.

THE FRUIT AND ITS TREATMENT.

As some of the varieties are edible before becoming soft, that is, they are not astringent, it follows that in the event of a Northern market, these varieties would be the most desirable to grow. To one not acquainted with persimmons, a single effort to eat an unripe specimen would be sufficient to prevent any expansion of the market. It has been found that in Japan the astringent varieties are subjected to a method of treatment, by which the hard unripened fruit is confined in sealed recepticles for certain periods of time, after which upon removal, it is found that their astringency has disappeared. It has been found, too, that subjecting the astringent fruit to the fumes of certain chemicals will accomplish the same purpose,



SEEDLING. (FIG. 12.)

and while very small experiments were carried out at the Station this season, sufficient information was not obtained to warrant a statement at this time. It is sufficient to say that the treatment of the astringent fruit in order to correct the astringency is a problem that will be successfully solved in the very near future, thus removing the greatest hindrance to the growing of

Japanese persimmons, and the further expansion of an excellent market for them.

As a fruit they are rich in sugar, the different chemical analyses showing an average of about 16 per cent for the cultivated varieties. While this is slightly less than the percentage of sugar in our native varieties, it is much greater than the amount found in apples, which average less than 8 per cent. An alcoholic beverage is made from them in Japan.

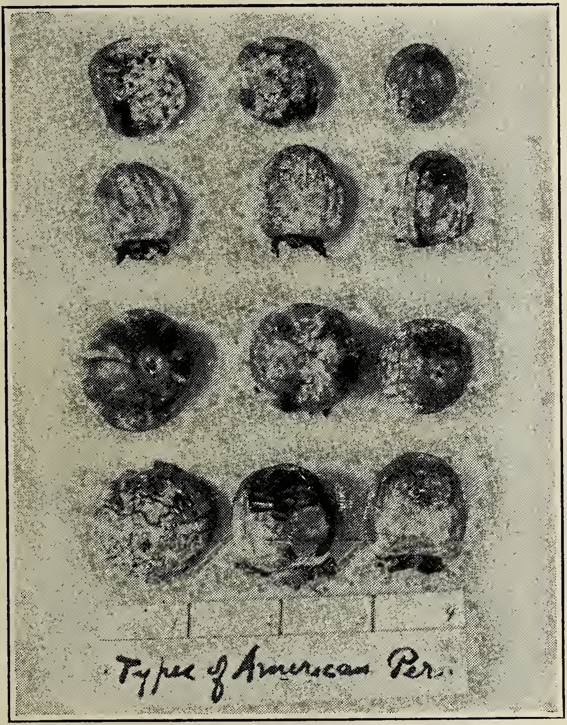


FIGURE 13.

They ripen before frost in Louisiana—in fact, a frost is not necessary for their maturity, contrary to the prevailing belief.

ENEMIES AND DISEASES.

There are comparatively few enemies and diseases of a very serious nature, that attack the Japanese persimmons. There are several leaf diseases, which nearly defoliate the trees very late in the season. As this occurs really about the time the leaves begin to fall, little damage is done. Some varieties are much more resistant to fungous diseases than others. The seasons also vary, and some years the diseased leaves are hardly noticeable. In the event of serious trouble from leaf-destroying diseases, there is always a remedy at hand in the Bordeaux Mixture, which is universally used for the purpose of preventing or checking them.

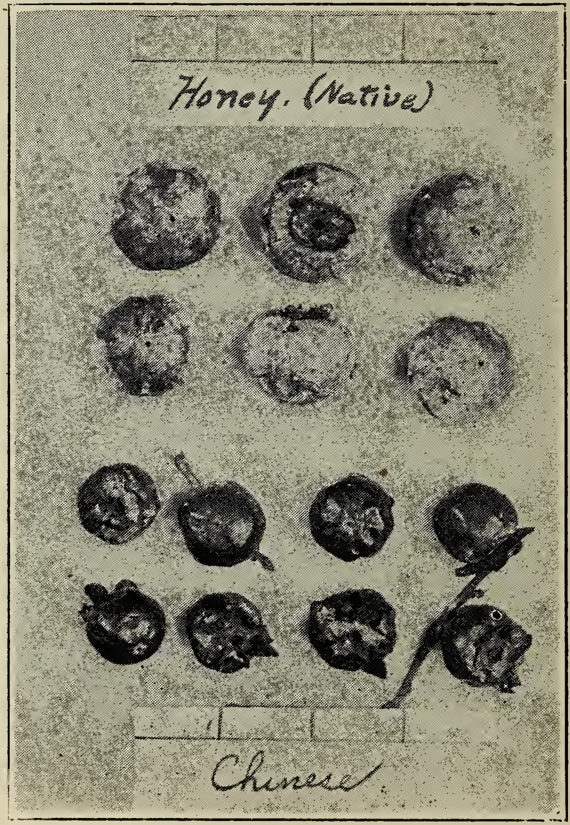


FIGURE 1.

Among the insect pests, the Twig Girdler (*Oncideres cingulatus*) is the one most frequently heard from. The female beetle, which is about one-half an inch long, and of a dark gray-brown color, deposits her eggs near the end of the young twigs, and girdles the twig below them.

In due time the twig dies, breaks off and the young hatch and come out. A few complaints have been made concerning the girdler. The remedy is to gather the twigs and burn them, not a very difficult task to do, and if the fallen leaves and broken twigs be raked and burned from each tree, not only will the Twig Girdler be under control, but the leaf diseases also will be held in check.

By far the most serious pest at the Station has been the mocking bird. At the time the Japanese persimmons are beginning to mature, there is a scarcity of food for them and they injure a great many.

Some years this becomes a serious question. To cover the trees with gauze is out of the question. No one would think of shooting the mocking bird as a pest, outside of the fact that it has legal protection. The remedy will come with the future treatment of the persimmon for market. Gathered while still hard, treated for astringency and put on the market while still solid but edible, the fruit will be cared for and put before the consumer before the mocking birds make any serious attacks upon them. While there are other birds which are troublesome, the one mentioned is the chief offender.

MARKET.

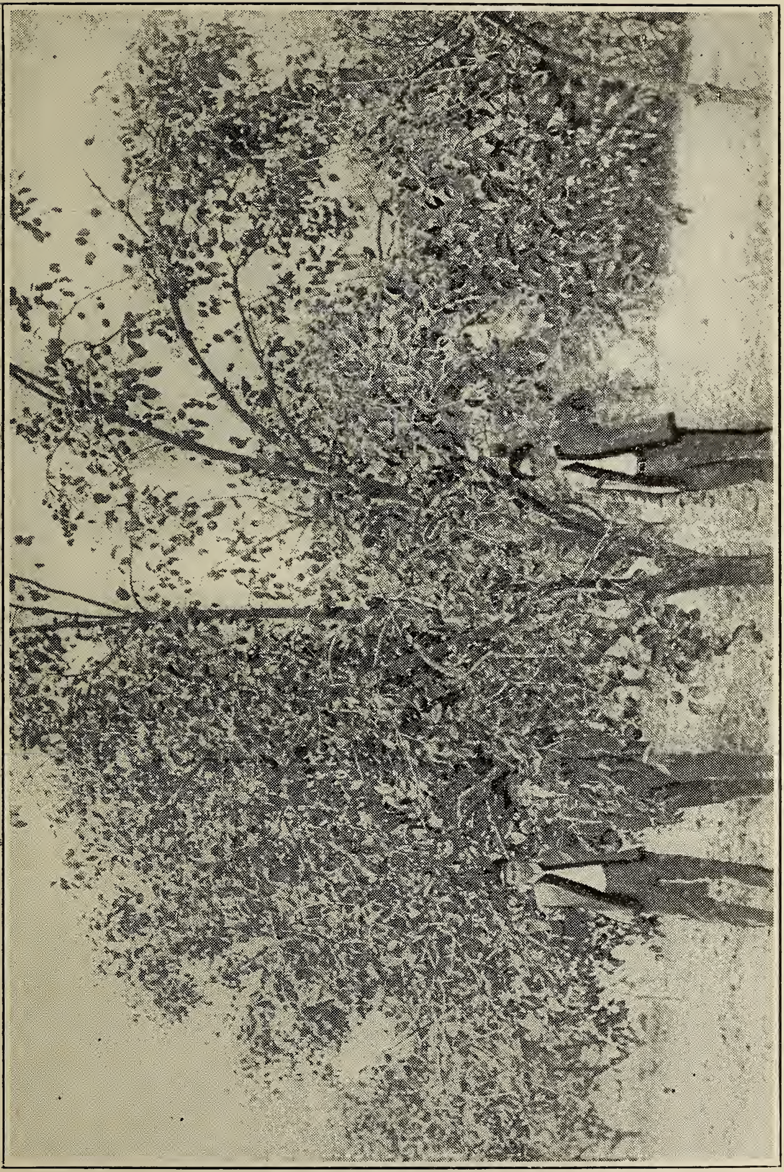
The Northern people love tropical and semi-tropical fruits. Our own people love a variety of fruits. The first Japanese persimmons put upon the markets in the South and the North were received with caution, yet when well ripened, were easily disposed of. The present sources of supply of these fruits are California, Florida and Louisiana, with California leading. While in our Southern markets they are found in bulk, the Californians pack and ship in neat crates. The California crate is similar to an egg crate, with capacity for 50, 36 or 32, according to the size of the fruit. The fruit is unwrapped and through the slats of the crates it makes a very good appearance, and the prospective buyer can readily see the size, color and quality without breaking the package. These crates of persimmons sold in the Chicago market during November, 1907, for $1.10 to $1.30 per crate. This means a very good profit to the grower, and there is no reason to believe but that good Japanese persimmons, packed nicely, will continue to find a good market for some time to come. In bulk they bring about $1.00 to $2.00 per bushel, and by the dozen 30 to 80 cents.

USES.

While we are not fully acquainted with all the uses to which Japanese persimmons are put in their native country, it is quite probable that their use is as varied as is the case with apples in the Northern States. Its general use at the present time, however, is as a fresh fruit. When fully ripe, it may readily be eaten out of hand, but as some varieties are quite soft, the use of a spoon will facilitate matters greatly. Some prefer them served with cream. The non-astringent varieties may be pealed and eaten as a desert fruit, or sliced and served as a salad. Their characteristic flavor, varying in the different varieties, is found to be delicious by a great majority of people. Methods of preserving or evaporation have not been ascertained, but the latter is a common practice in Japan.

CONCLUSIONS.

1. Japanese persimmons may be grown with the greatest success in all sections of Louisiana.
2. They are easily grown, easily marketed and stand transportation well.
3. A ready market awaits them.
4. They are delicious as a salad or desert fruit.
5. A number of the varieties are not astringent, therefore may be eaten while still hard.
6. Astringent varieties will soon be treated so as to correct this undesirable quality.
7. They have comparatively few diseases and enemies.
8. They are valuable as an ornamental tree in the home yard.



JAPANESE PERSIMMON TREE IN FRUIT.

Bulletin No. 100 January, 1908.

Agricultural Experiment Station

OF THE

Louisiana State University
and A. & M. College,

BATON ROUGE.

The Root Disease of Sugar Cane

H. R. FULTON, M. A.

BATON ROUGE:
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Root Disease of Sugar Cane in Louisiana

HISTORICAL.

The root disease of sugar cane was first described from Java in 1895 by Dr. J. H. Wakker, who gave it the name ''Dongellanziekten,'' the disease of the underground part of the cane stalk. He observed the disease on the sprouting cuttings of the ''nurseries'' and the older canes of the fields; and he found the causative organism to be a fungus which he described and proposed as a new species, *Marasmius sacchari.* This fungus, primarily a saprophyte, has acquired the habits of a wound parasite, and finds in connection with cane cuttings and cane plants conditions most favorable for its full development and fruiting.

At about the same time studies upon a similar disease were begun in the British West Indies, and were carried on for a number of years by several investigators. An extensive account of the disease, however, was not published until 1903, when Mr. A. Howard gave the results of his studies in Barbadoes. He attributes the disease to Wakker's species of *Marasmius*, and adds materially to the knowledge of the conditions favoring the attacks of the fungus upon the cane plant. Further observations made by Mr. F. A. Stockdale lead to the opinion that probably more than one species of *Marasmius* attack sugar cane in the West Indies.

In 1905 Mr. L. Lewton-Brain published a preliminary account of the disease in the Hawaiian Islands, and in 1906 there followed a very complete account by Dr. N. A. Cobb. According to these writers a certain amount of the root disease occurring in the Hawaiian Islands is caused by a species of *Marasmius* which differs in minor characters from Wakker's species, and is accordingly proposed as a new variety, *Marasmius sacchari* variety *hawaiiensis.* Dr. Cobb also attributes a considerable amount of the root disease in the Hawaiian Islands to a fungus of a very different type, *Ithyphallus coralloides,* a member of the so-called stink-horn group of fungi. He expresses the belief that further study will show that still other fungi, having the same general mode of living, play a part in causing root disease.

APPEARANCES INDICATIVE OF ROOT DISEASE.

Affected stools show very constantly and markedly root systems that are deficient in their development, and that show a considerable percentage of dead roots. Such stools have a weak hold on the ground and may be pulled up with comparative ease; they are also the ones most generally prostrated by storms. The canes of these stools are reduced appreciably in size and weight. The leaf system is reduced; and when the supply of available moisture in the soil falls below normal, symptoms of water starvation are apparent, while other stools maintain a normal appearance. When the drouth conditions become more severe, a large percentage of affected stools die. These effects are caused by the deficiency in root system. They are more pronounced in stubble than in plant cane, for reasons that will be indicated later. The lower leaf sheaths (shuck) of affected canes do not fall away, leaving the older part of the canes clean, as is normally the case, but they adhere closely for some distance, as much as eighteen inches, from the surface of the ground, and can be removed only with difficulty. (Fig. 1.) They are seen to be cemented together by the whitish mycelium of a fungus which has a characteristic moldy odor. Under favorable conditions, which seem to occur with comparative infrequency, the toadstool fructifications of the fungus are to be found in connection with the mycelium.

This fungus which cements the leaves is the organism that causes the destruction of the cane roots, from which result the acute symptoms of disease and the ultimate reduction in the yield. The fungus is primarily a soil-inhabiting organism, and its appearance above ground on the somewhat moist and nutritious leaf sheaths where conditions are favorable for its growth, is rather incidental. The fungus may infest a stool of cane, especially in the plant crop, and cement the sheaths in the characteristic way, and yet not affect the roots or injure the stool appreciably in any way. Such a stool can not strictly be regarded as diseased; and yet with the fungus present it is probable that sooner or later the living tissues will be permeated, and typical root disease induced. On the other hand, even in stools that suffer most from root disease, it is usual to find a certain percentage of the individual canes without indications of the fungus above ground. But with all of this, the matting of the leaf sheaths is a most useful indication of the actual or potential presence of root disease. This matting is not very conspicuous until about the time the cane "begins to joint," about August.

THE CAUSE OF ROOT DISEASE.

It has already been indicated that in other countries several distinct fungi have been found to play a causative role in inducing root disease; and we are led to regard the root disease of sugar cane as one presenting a definite group of symptoms which result from the destruction of the cane roots by the attacks of some one of several fungi which differ much in their taxonomic relations, but have the same general life habits. These fungi are not aggressive parasites; for the most part they flourish on non-living parts of the cane, and only under special conditions and in particular situations can they directly attack living tissues.

In Louisiana, a species of fungus which is regarded as being in all probability *Marasmius plicatus,* Wakker, is found constantly associated with growing cane or with decaying cane parts. The canes on which it occurs show generally, though not invariably, a dwarfed growth, a reduced root system, and, during a period of drouth, are the ones to succumb most readily; canes without the fungus have nowhere been observed to show generally these symptoms. Mycelium of the fungus has been observed in living and dead roots. Repeated inoculations with pure cultures have produced in living young cane plants the characteristic symptoms of root disease. The fungus has been recovered in pure culture from such artificially infected plants.

These facts lead to the conclusion that the species of *Marasmius* found generally on sugar cane in Louisiana, which is regarded as *Marasmius plicatus*, Wakker, must be added to the list of fungi that have the ability to induce the so-called root disease of sugar cane.

Specimens of Louisiana cane showing the characteristic mycelial growth, but not the fructifications, have been submitted to the proper authorities at the experiment stations in Java, Hawaii and Barbadoes. In all cases the reports have been that in so far as could be judged from the material, the appearances were those of root disease.

With regard to two species of fungi belonging to the stinkhorn group, and found in some numbers in the cane fields of the State, definite statements cannot be made at present.

THE FUNGUS.

Marasmius plicatus belongs to the toadstool or mushroom group of fungi. In common with other members of the group, the organism has a vegetative part known as the mycelium, made up of minute branching white threads which ramify through the nutrient substratum. It is this mycelium that is found infesting the dead roots and the matted leaf sheaths of the cane plant. When conditions of moisture and food supply are favorable there develop in connection with the mycelium the fructifications of the fungus. They appear at first as small, ball-like masses of mycelium; these increase in size, and gradually become differentiated into the component parts of the fully developed fruit body. These fructifications are seldom observed since they are formed with comparative rarity, and since they remain fresh for a very short time.

The fruit body (Figs. 2 and 3) has the characteristic toadstool form, with an upper expanded portion, the cap or pileus, and a supporting stalk, the stipe. The pileus is dirty white, becoming somewhat darker with age; it is usually about three-fourths of an inch in diameter, but may attain a size of an inch and one-fourth. When young it is convex, and at maturity is almost flat or perhaps slightly concave. Its surface is smooth. On the under side are the radiating gills which have an even, thin edge, and a straight, radial direction. The long gills extend from the margin to the stem, and are attached to the stalk itself rather than to a prominent ring about the stalk. Other shorter gills extend from the margin just far enough to fill in the angles between the longer gills. The stipe is about equal in length to the diameter of the cap, or in some cases, somewhat less. It usually arises from the side of the leaf sheath, and is somewhat curved so as to bring the cap into a horizontal position. It is normally attached to the cap at its central point, but at times this attachment is somewhat eccentric. The stipe is smooth externally, except at the base, which is downy and also enlarged. The whole fruit cap persists for about a day, and then gradually dries, losing its form, but not undergoing immediate disintegration. When moistened it regains something of its original form. The gills produce upon their surface the spores of the fungus (Fig. 7), which are minute oval bodies of microscopic size. They show a pure white color in mass. Their function is to reproduce the fungus plant. This they do, under suitable conditions, by sending out a small thread which may by its continued growth develop into the mycelium of a new generation of fungus.

This fungus grows saprophytically upon decaying vegetable matter, seemingly showing a rather strict selective preference for parts of cane plants. In the laboratory it grows well upon a wide range of nutrient media. In addition to this saprophytic mode of living the fungus has the ability to attack living tissues, probably only when their vigor is impaired, and thus to adopt the mode of life of a parasite. It is in this role that the fungus becomes of economic importance in causing damage to cane plants.

MODES OF DISTRIBUTION.

The spores of fungi are the parts specially formed and adapted for the reproduction and dissemination of the parent organism. Spores are produced in very large numbers on the under side of the fruit caps of *Marasmius plicatus,* and they germinate with comparatively little difficulty. But the fruit caps are produced only under exceptionally favorable conditions, and there is no evidence of any increase of the fungus following the production of the spores in a given locality. In the mushroom group as a whole reproduction by spores seems to be of relatively little importance. On the whole, it seems probable that spores have a comparatively unimportant part to play in the propagation of the sugar cane *Marasmius.*

To a much greater extent than among higher plants, detached portions of the vegetative part of fungi can reproduce the plant. Bits of the mycelium of the root fungus of sugar cane grow and spread rapidly under favorable conditions. A small amount on the butt of a planted stalk may be the means of infecting one or more stools of the plant cane to which it gives rise. It is thus by the planting of infected stalks that the root fungus is most efficiently spread from field to field, and continued from year to year.

During the season of 1907 three field tests on two plantations in West Baton Rouge Parish were made to determine what part the planting of affected canes play in the continuance and spread of the fungus. The results were as follows:

Experiment	Rows	Seed Cane	Percentage Affected Stools	Percentage Affected Stalks
A	1	Affected whole stalks	73	30
A	2	Sound whole stalks	23	17
B	1-3	Affected whole stalks	85	63
B	4-6	Sound whole stalks	63	35
C	1-4	Affected whole stalks	89	61
C	5	Affected lower halves	100	91
C	6-10	Sound whole stalks	1.7	0.7

It is noticeable that the amount of fungus was constantly greater when affected stalks were used for planting, and was greatest for the row planted with the lower halves only, that is, with the part having the fungus most abundant. At the outset nothing was known regarding the amount of the fungus that might be present in the soil. In experiments A and B it was later very evident from the showing of the control rows and of the fields in question generally, that the soil was everywhere thoroughly infested with the fungus. This accounts for the rather high percentages for the rows planted with sound cane in these two tests. In experiment C there was very little evidence of the presence of the root fungus in any part of the field, and the control rows remained almost free from it. The cane used for the general planting in all three fields was from the plant crop and showed an unusually small percentage of stalks with adhering shuck.

A third means of distribution is by the persistence of the mycelium of the fungus in the decaying roots and other cane trash of the fields. A certain amount of such infected material must of necessity remain over from one season to the next and can become the source of infection for the new crop of cane. The root fungus similarly protected can withstand lower winter temperatures than can the cane. Young cultures were killed by an exposure of six hours to temperature ranging from 3 degrees to 14 degrees Fahrenheit, but survived an exposure of 45 minutes to the same range. Exposure to 32 degrees for six hours was not fatal. Growth took place slowly during a prolonged exposure to 50 degrees Fahrenheit, and most rapidly at about 85 degrees Fahrenheit. Young cultures survived exposure of 45 minutes to 122 degrees Fahrenheit, but were killed by exposure to the same temperature for one and one-quarter hours.

Further data are necessary before statements can be made regarding the period of persistence of the fungus in the soil when not planted in cane.

OCCURRENCE IN LOUISIANA.

The root disease of sugar cane has existed for a long time in Louisiana and is now distributed rather evenly through all the cane-growing districts of the State. Fructifications which have rendered the identity certain, have been collected from six parishes, and canes with matted leaf sheaths of characteristic appearance have been seen from as many more parishes. The percentage of infestation varies much with local conditions, there being often more noticeable differences in this regard between different parts of the same plantation than between the plantations themselves. It is a usual thing to find the purple plant cane affected to the extent of 5 to 8 per cent of the stalks, and purple first-year stubble 12 to 18 per cent. In the case of D 74, 1 to 3 per cent and 4 to 8 per cent are usual figures for the corresponding crops. Some of the worst fields seen have been in purple cane, and have had 90 or 95 per cent of the stalks infected.

These figures are not to be taken as representing in any way the loss due to the root disease. Affected canes, although usually small and light, are by no means a total loss. And the figures do not take into account the gaps in stands and the reduction in number of canes per stool, that make up the large loss from root disease.

It has been very generally observed that D 74 shows a less degree of infestation than purple. The following figures, which are based on counts from comparable plantings, give indication that the seedling canes D 74 and D 95 are less infected than the two most common home varieties when grown under the same conditions:

FIRST YEAR STUBBLE.

	Fall Plant.	*Spring Plant.*
Striped	34.3%	30.6%
Purple	26.6%	22.9%
D 95	22.2%	16.7%
D 74	14.4%	15.0%

Each percentage represents the average condition of nine rows. The cane used for spring planting was windrowed from the lot from which that used for fall planting was taken.

From another planting during a different season the following figures have been deduced:

SECOND YEAR STUBBLE.

	Fall Plant.
Striped	27.9%
Purple	20.2%
D 95	15.3%
D 74	12.5%

Whether this difference is due to a greater natural resistance in the new canes, such has been reported for the Yellow Caledonia variety in the Hawaiian Islands, or whether it is merely the result of the newness of the varieties, which, on account of great care in the handling of them, have been up to this time less exposed to infection by the root fungus, are questions that can be definitely answered only after further investigation. Nothing is known regarding the relative amounts of infestation of the seed cane used in the above-mentioned plantings.

MODE OF ATTACK.

The two ways in which the root disease fungus works injury to the sugar cane are by destroying the roots, and by smothering the germinating buds. In each case the effect may be produced in an indirect and mechanical way, or more directly by the parasitic attacks of the fungus.

When a number of leaf sheaths are firmly cemented about a portion of the stalk, there is a very serious obstruction to the proper growth of eyes and roots from the nodes involved. It is frequently the case that before such canes are cut, roots are protruded in large numbers from the enveloped nodes above ground; these grow to the length of a fraction of an inch and die, their tips becoming black and shrunken, and their tissues dry and spongy. A microscopic examination shows generally the mycelium of the root fungus within their tissues (Fig. 6). When cuttings from such badly enveloped canes are subjected to conditions suitable for the development of roots and shoots, it is found that in number and vigor of both, such cuttings fall far below sound cuttings, and appreciably below cuttings of the same lot from which the adhering shuck had been removed before planting.

The fungus has the power to attack roots at any period of their growth. When it is brought in contact with a root either naturally or artificially, there can be seen at the first a reddening of the surface of the root at the place of contact; this is followed by a brown discoloration of the area, and later by slow disintegration. A microscopical examination in the early stages shows an abnormal condition of the cells of the affected area, but does not show any penetration of the fungus even into the outermost cells. A little later the fungus is found to have invaded these cells, and by degrees it extends to remoter portions of the root, its advance being always preceded by the death of the cells just ahead. This killing of the cells is in all probability brought about through the agency of substances excreted by the fungus.

The parasitism manifested in these attacks is of a low and weak sort. Unlike more accomplished parasites, which can penetrate and draw sustenance from the living tissues of the host without destroying them, the root fungus of sugar cane must kill the tissues before it can invade or feed upon them. In living upon such tissues only after they are dead, it shows nothing more than a saprophytic mode of living; but the ability which it has to kill lifts it a little above the rank of saprophyte and entitles it to be regarded as a weak parasite.

The abundant presence of the fungus in the adhering leaf sheaths of affected cuttings places it in a situation most convenient for attacking the roots as they are put forth. The growth upward of the fungus on the outer and lower leaf parts of the developing shoot gives it a similar situation with respect to the roots subsequently developed from the underground nodes of the daughter plant. Its persistence on such underground parts of the plant cane keeps it in a position to attack most readily and at an early stage the growing parts of the stubble crop.

CONDITIONS FAVORING ATTACK.

There is a constant struggle for supremacy between a parasite and its host. Those host plants that possess greatest powers of resistance are affected slightly or not at all; less resistant plants succumb readily. In the case under consideration, the balance seems very even between the root fungus and the cane plant. When all conditions are conducive to vigorous, thrifty growth of the cane, the fungus, though present about the stool, has little or no effect upon it. Anything that disturbs such an optimum condition of the cane and weakens it, may be the occasion of more successful attacks by the fungus and greater consequent destructiveness. Cane requires careful cultivation for its best development; the root fungus is a wild plant, a low organism having the ability to withstand and to thrive under a far wider range of conditions than its host. In this way the fungus enjoys an initial natural advantage in the struggle.

Some of the more important conditions that tend to lessen the vigor of the cane and its powers of resistance, and so to increase the chances for the fungus to work injury, are these:

1. *Slowness of germination and early growth.* It is a matter of common observation that fall plant cane and more especially stubble cane have a larger percentage of infection than spring plant cane. This condition probably arises from a long continuance under ground of the fall planted cane and the the stubble stocks before active growth begins, during much of which time the root fungus grows, becoming so well established upon the cane parts as to readily infect the young plants; and infection is further favored by the slow and intermittent character of the growth at first from these parts. It is further

likely that the canes from a stubble crop so generally used for fall planting, have a higher initial infection than the seed cane used in spring planting; this would account for a certain difference in the degree of infestation of the resulting crops.

2. *Improper cultural procedures.* It goes without saying that cane is below its best when proper care has not been taken in the preparation of the soil for planting, and in all subsequent operations until the crop is laid by. The point to be emphasized in the present connection is that the unhealthy, weakened condition of the cane that is the direct result of poor cultivation, is itself a predisposing factor for the destructive attacks of the root fungus. Especially serious are these when cane in its earlier and more susceptible stages of growth has its powers of resistance weakened by improper or inadequate cultivation.

3. *Unsuitable soil.* The root fungus through its ability to subsist upon decaying plant parts, may be found rather abundantly in soil too thin for the proper growing of cane. The under developed and struggling cane plants in such unfavorable situations may fall an easy prey to the root fungus.

4. *Bad drainage.* It is commonly the case that heavy, poorly drained soils show very large proportions of the canes infested with the root fungus. The wetness of such lands makes them especially suitable for the growth of the fungus; and the lack of proper drainage prevents the best development of the cane, with a resulting increase in infection.

5. *Unfavorable seasonal conditions.* Drouth conditions are those under which the worst effects of the root disease are brought about. These effects are not due to any spread of infection to new stools, but to the rapid and pronounced deterioration of stools already infected, the stubble crops being affected far more extensively than the plant crop. The stunting and dying of the stools in such periods of drouth follow directly from the insufficiency of their root systems; and it has been pointed out that the root disease fungus, by attacks upon the young roots, may and does seriously reduce the root systems of the affected stools. In a favorable season those stools, with a slight reduction in root system, show little or no falling off, and even those with a considerable reduction survive, with a loss, however,

in number and size of canes. But when conditions are such as to render it difficult or impossible for stools with full root systems to secure the proper amount of water and food materials, those stools at all lacking in roots suffer appreciably; and those greatly lacking in this regard die.

6. *The stubble crop.* The root disease seldom causes great loss in any but the stubble crops. Some of the causes of this have been indicated. On the one hand, the root fungus has had a chance during the interval between the taking off of the plant crop and the sprouting of the stubble canes, to become thoroughly established in the trash and decaying parts about the stumps. On the other hand, the roots and shoots begin their growth under very disadvantageous conditions which result in large measure from the impossibility of thoroughly working the soil immediately around the stumps.

In addition to causing the death of stubble cane during its period of growth and the general stunting of affected stools that survive, the root fungus probably plays an important part in killing entirely during the winter months some of the stools so as to leave noticeable gaps from the very first in stubble crops when the plant crops had a perfect stand. It is believed that this effect is brought about by the complete killing and smothering of roots and eyes, rather than by disintegration of the nodes themselves through the direct agency of the root disease fungus.

PREVENTIVE MEASURES.

Procedures for the control of the root disease are at once suggested by an understanding of the modes of invasion and dissemination of the fungus, that is, its causative agent. Briefly summarized, such procedures must follow the lines of proper cultivation and the use of sound seed cane. Preventive measures must be relied upon, not remedial ones.

1. *Careful cultivation.* It is necessary but to mention in this connection proper tillage, active and thorough cultivation, especially of the stubble crops, good drainage, and rotation of crops. When it is a matter of combatting root disease, all possible care must be taken that the environmental conditions of the cane plant are such that it may maintain a healthy and vigorous condition especially during the critical period of early

growth. Effective resistance at this time goes far toward securing freedom from the devastating effects of the root disease.

2. *Selection and disinfection of seed cane.* It has been seen that the planting of infected canes, that is, those having the leaves matted at the base, not only introduces the fungus throughout the field, but does it in such way that the plant stools readily become infected. To avoid this is important. Sound cane only should be used in planting. Non-infected seed cane may be secured in two ways: (1) By careful inspection of cane for planting with the rejection of all suspected ones. (2) By thorough disinfection with some good fungicide, such as Bordeaux mixture. Of these two methods the former is less expensive, but is probably less effective, since there is always a chance that some very slightly infected stalks will be overlooked. Both methods are tedious and costly when carried out on a plantation scale. But by setting apart a tract of superior land that is free from root fungus infestation, for growing seed cane, and by careful selection and perhaps disinfection of the seed cane for the general planting can be obtained at a minimum expense.

2. *Resistant varieties.* All the evidence now at hand shows greater freedom from root disease in the case of the seedling varieties D 74 and D 95. Exact statements regarding a possible natural resistance to the disease possessed by these must be deferred until tests now in progress yield results. In any event, there is a certain amount of present benefit as regards freedom from root disease to be derived from the planting of the new canes.

4. *Destruction of infected trash.* The mycelium of the root disease fungus lives over from season to season in the dead and decaying parts of affected canes that are left in the field. These are an important source of infection to the new crop. Burning over the fields destroys much infected trash; and this practice, as well as the removal as thoroughly as possible of old cane stumps, tends to hold the root disease in check.

5. *Resting land from cane.* In some instances the root disease fungus has become so thoroughly distributed and so well established in particular fields as to render the operation of the foregoing measures inadequate for a proper control of the

disease. The application of fungicidal substances to the soil over large tracts has generally proved unsuccessful for the eradication of fungi which live in the soil and attack the underground parts of plants. It is not likely that any degree of success would attend the use of such substances in the present case. Since there is no evidence that the sugar cane *Marasmius* has any other plant than sugar cane for a host plant, it is reasonable to suppose that the amount of its persisting in the soil can be materially reduced by keeping cane off the land for several seasons. The usual rotation covering a three or four-year period, doubtless has its beneficial effect in lessening the amount of root fungus in the soil. Unfortunately, data are too incomplete for anything to be said about the length of time necessary for the complete eradication by this method of the fungus from a badly infested field. Frequent plowing for the purpose of thoroughly exposing the soil to the sun and drying it would doubtless destroy much of the fungus. The stubble crops are not only the ones in which the greatest losses occur, but they are the ones that best serve as nurseries for the fungus. When the plant crop on any area is so badly affected by the root disease as to make the margin of profit dangerously small, it should be borne in mind that the stubble crop will show even worse effects of the disease, and that the keeping of the land in cane for a second season under the circumstances will increase the chance for serious infection of subsequent cane crops; and the matter of leaving the stubble or planting an entirely different crop should be decided in the light of these considerations.

Success is attending the use in other countries of the measures mentioned. A recent letter from Dr. H. C. Prinsen-Geerligs conveys the information that it is now difficult to find specimens of the root fungus in Java. The system practiced there of quick rotation with the elimination of the stubble crops, and the great care taken with the material for planting, have no doubt played an important part in bringing about the results. The work of control in the Hawaiian Islands has been too recently undertaken for definite results. Published accounts of late date from the British West Indies indicate that careful cultivation, rotation of crops, selection of sound seed cane, and the choice of disease resistant varieties, are measures that are being used there with an encouraging degree of success.

TECHNICAL DESCRIPTION.

Specimens of the Louisiana root disease fungus have been submitted to Dr. W. G. Farlow, who has very kindly examined them, and has expressed the opinion that they are to be regarded provisionally *Marasmius plicatus,* Wakker. Since it has not been possible to make comparison with a specimen of this species, it has seemed advisable to include the following technical description of the Louisiana fungus:

Pileus 12-35 mm., usually 15-20 mm., across; flesh thin, somewhat pliant; convex with the margins somewhat incurved, then expanded and more or less depressed; even, glabrous, at length rugose and wrinkled; whitish, becoming tawny when dry. Lamellae adnexed, sometimes joined behind and leaving the stem; distant, unequal, often connected by veins, rather broad, thin, even, white. Stipe stuffed, then hollow, fibrous inside, with a cartilaginous cuticle, almost glabrous above, base tuberculose and flocculose; whitish, 5-20x0.8—1.8 mm., usually 12x1 mm. Spores white, ovate, and with a prolongation at the attached end, 6.8x5.6 mm. Mycelium whitish to cream color, flocculose becoming cemented by gelatinous envelopes, sparingly septate, with clamp connections, about 3 mm. in diameter. On leaves, roots and decaying parts of sugar cane, having the habit of a weak parasite. Greparious, scattered or somewhat cespitose.

The sporophores are shown in Figs. 2 and 3; the spores in Fig. 7, and the mycelium in Fig. 8.

EFFECT OF TEMPERATURE ON GROWTH.

In testing the effect of different temperatures upon the mycelium of *Marasmius plicatus,* cultures in test tubes on slightly acidulated potato agar were used. The exposures were made when growth was well started, that is, 20 to 30 hours after inoculation; but in a few instances cultures four or five days old were tested without showing important difference from the younger cultures. The more important results are given below:

Exposure.	Temperature degrees C.	Growth during exposure.	Growth after exposure.
6 hours	—10 to —16		None. Dead
½ hour	—10 to —16		Fair
6 hours	0		Good
5 days	3 to 5	None	Good
5 days	11	Slight	Excellent
5 days	20	Good	Excellent
5 days	25	Excellent	Excellent
5 days	30	Excellent	Excellent
5 days	35	Good	Excellent
5 days	41 to 42	None	None. Dead
6 hours	45		Good
2½ hours	50		None. dead
1¼ hours	50		Fair
¾ hour	52		Fair

RESISTANCE TO DRYING.

When plugs of sugar cane from test tube cultures nine to ten months old and thoroughly air dry were placed in moist chambers, growth was secured in about one-fourth of the trials. The fungus was also recovered from the mycelial growth well up on the sides of flask cultures of a like age, with steamed rice as culture medium. A cane stalk that had remained for ten months in the rather dry laboratory atmosphere yielded a good growth from detached portions of the matted leaf sheaths.

CONDITIONS FAVORING FRUITING.

Before fructifications were found in the field various attempts were made to secure them from pure cultures. For this purpose six strains of fungus were grown in flasks on a wide range of nutrient media and under varied conditions of temperature and moisture. The mycelial growth was very much the same in all cases, and nothing suggestive of sporophore formation was apparent. The first fructification seen was found in June on a cane plant grown in a tub and naturally affected with root disease from the infected cutting planted. The lower part of this stalk had been covered with a glass cylinder pushed into the ground and plugged at the top with cotton, so that the atmospheric conditions about the sporophore were rather moist. On August 4th, after several days of cloudy weather, with intermittent showers, the fruit-bodies were found in great abundance on several plantations examined, and their constant association with the mycelium cementing the leaf sheaths was definitely determined. They were also found on detached pieces of decaying cane that were permeated with typical *Marasmius* mycelium, and on exposed broken roots of still living cane stools, the roots also being filled with the mycelium. From this time until the last of September it was possible to find fruit bodies whenever conditions were sufficiently wet in the cane rows, and not during drier periods. The fruit caps were usually found on the bases of the stalks within an inch or two of the surface of the ground, where the leaf sheaths were quite moist. Careful search during October and November, when moisture conditions seemed favorable, was unsuccessful. It would seem probable that rather high degrees of moisture and warmth are required for fruiting.

INOCULATION EXPERIMENTS.

In the first series, which included about twenty plants, cane-cuttings were sprouted in damp moss, and transferred to tubs filled with clean sand. Mycelium of three strains from pure cultures was used for inoculation material, and was placed in contact with the young sprouts at the time of setting out. The plants were watered with Sachs' nutrient solution. These inoculations were successful in three-fourths of the trials.

The second series was with young cane in the field several weeks before it began to joint, and while the lowermost leaf sheaths were apparently in a living condition. The inoculation material was from pure cultures of two strains, and was applied variously above the ground, below the ground, to uninjured sheaths, to incised sheaths, and in some cases with protection from drying by means of paraffined pasteboard cylinders, and in other cases without such protection. After two weeks, during which period weather conditions happened to be most favorable, every inoculation had taken.

After fructifications had been secured, successful inoculations were made with pure cultures from spores and from the stipe, as well as from the sheath-cementing mycelium.

In the laboratory roots were infected frequently and in various stages of development by growing them in moist chambers and placing portions of agar cultures in contact with them. Natural infection of the roots was secured readily by keeping nodes that were well covered by the adhering leaf sheaths in moist chambers. Young leaves inserted in test tubes containing an abundant growth of the fungus were readily infected.

In the case of each marked external discoloration and pathological change in the outermost cells followed quickly, and only after these had taken place could the fungus threads be found pervading the tissues. The infected areas afterward spread rapidly. The mycelium had an intracellular disposition. The first foothold on roots was usually at the point of emergence from the stalk where a slight projection of dead stalk tissue furnished a good feeding ground for the fungus (Fig. 6). Next in frequency under natural conditions was entrance from the root cap. Here it was noticeable that not the growing point, but that part of the root tip covered by the proximal portion of the root cap was the point of first entrance. In the roots the cortex was the region most extensively infested, and only occasionally were fungus threads found in the fibro-vascular bundles.

In the case of leaves, entrance was not generally through the stomates, but usually by a direct penetration of epidermal cells. Both parenchymatous and vascular elements were permeated.

All indications point to the conclusion that this species of *Marasmius* gains entrance only after the outside cells of the attacked portion of the cane plant have been killed; and this killing is accomplished presumably through some physiological activity of the fungus.

Infection experiments were not made with other plants than sugar cane. In only one case was the fungus seen growing out of doors on any other plant: in a field where there was abundant evidence of considerable soil infection, two fruit-bodies were found on a dead piece of Bermuda grass, and the leaf sheath was cemented to the stem by the mycelium in characteristic fashion.

LITERATURE.

The following references are to the more important published accounts of the root disease of sugar cane:

Wakker, J. H.: A disease of sugar cane due to *Marasmius sacchari* n sp. Med. Proefsta., East Java, n. ser., No. 16, 1895.

Wakker, J. H.: Concerning the sugar cane disease caused by *Marasmius sacchari*. Centrbl. Bakt. und. Par. Allg., 2, 1896.

Wakker, J. H., and Went, F. A. F. C.: A review of the diseases of sugar cane in Java. Med. Proefsta., East Java, n. ser., No. 22, 1896.

Howard, A.: On some diseases of the sugar cane in the West Indies. Annals of Botany, 17, 1903.

Howard, A.: A root disease of sugar cane in Barbadoes. Internl. Sug. Jour., 5, 1903.

Lewton-Brain, L.: Preliminary notes on root disease of sugar cane in Hawaii. Hawaiian Sugar Planters' Sta. Path. and Physiol., 2, 1905.

Cobb, N. A.: Fungus maladies of the sugar cane. Hawaiian Sugar Planters' Station, Div. Path. and Physiol., 5, 1906.

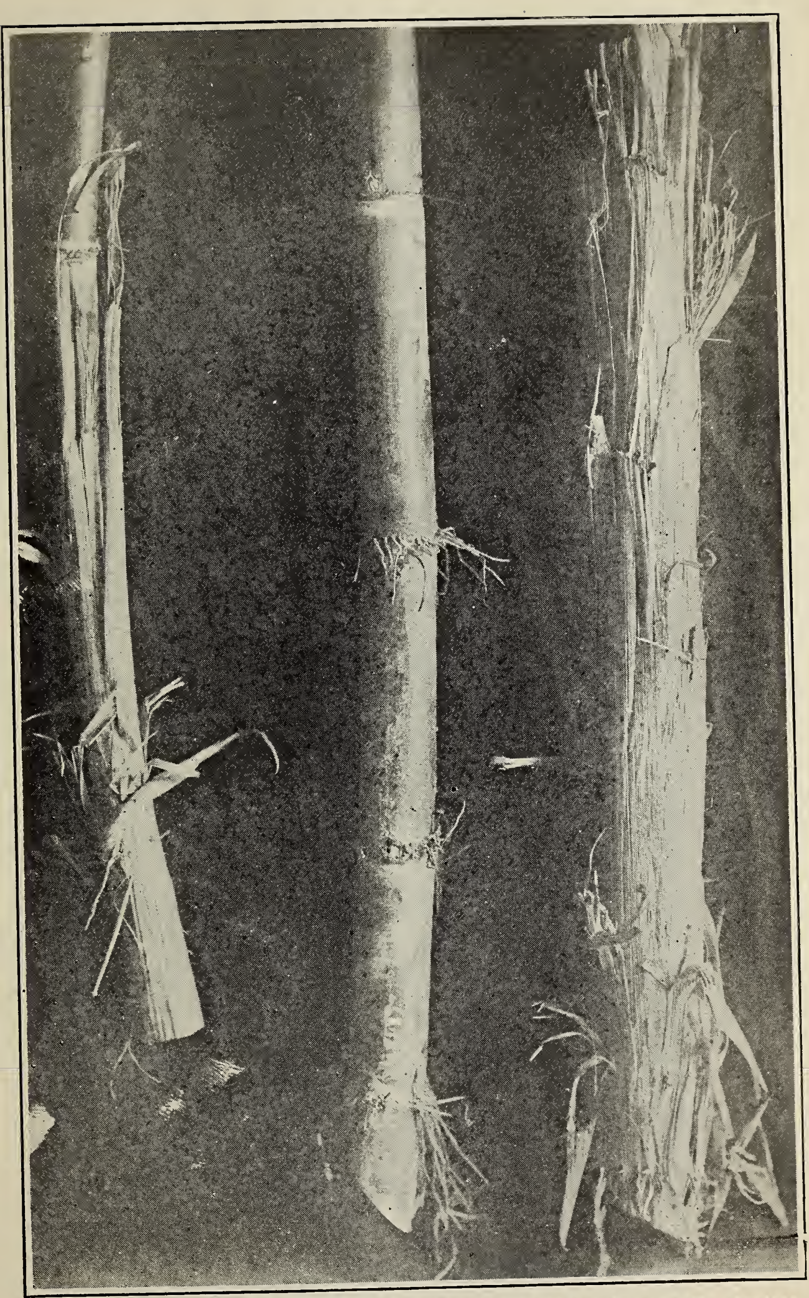

FIG. 1.—Two stalks of cane affected with root disease, showing the typical cementing of the shuck. The middle unaffected stalk is for comparison.

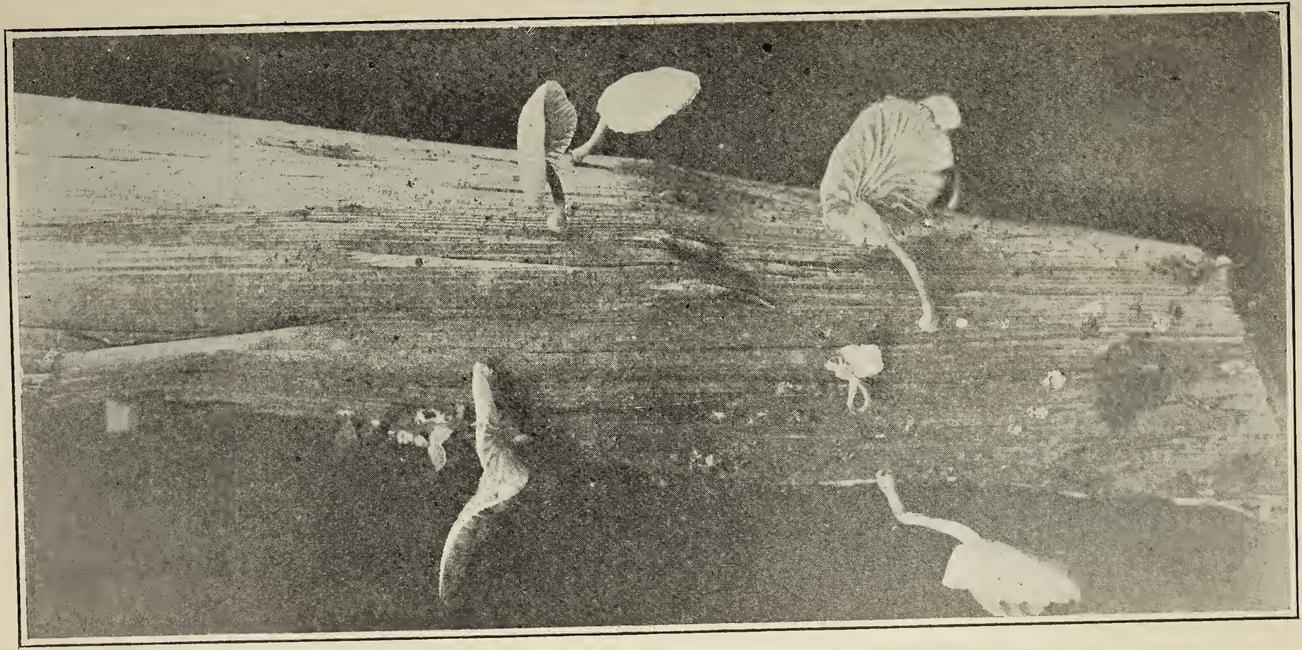

FIG. 2.—Fructifications of the fungus causing root disease of sugar cane in Louisiana, and supposed to be *Marasmius plicatus*, Wakker. x 4-5.

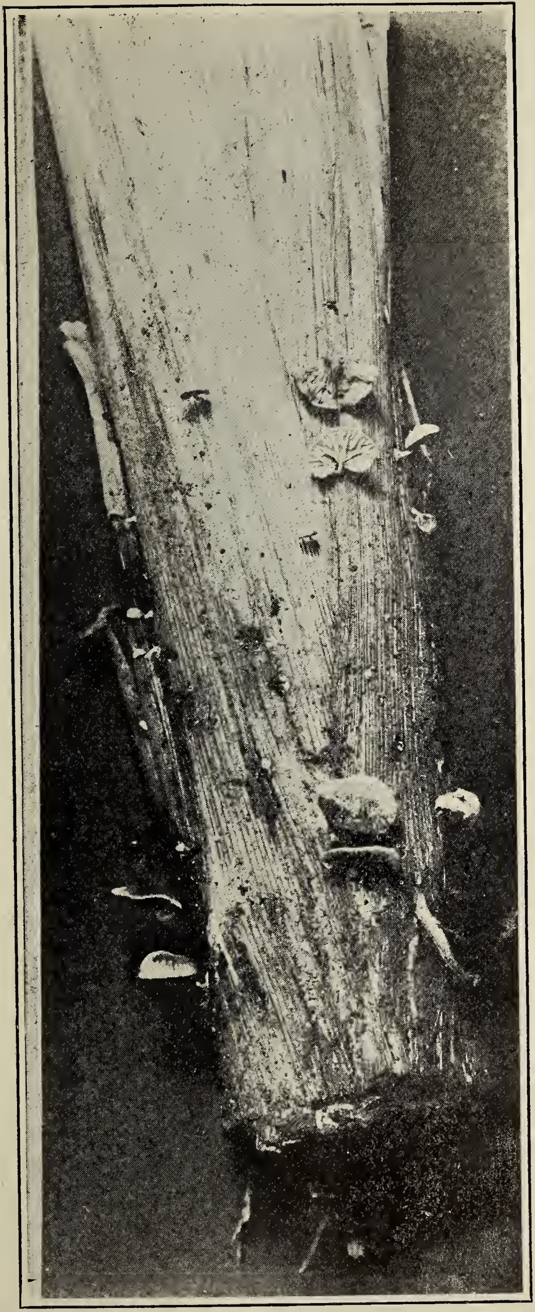

FIG. 3.—Fructifications of the fungus causing root disease of sugar cane in Louisiana, and supposed to be *Marasmius plicatus,* Wakker. x 4-5.

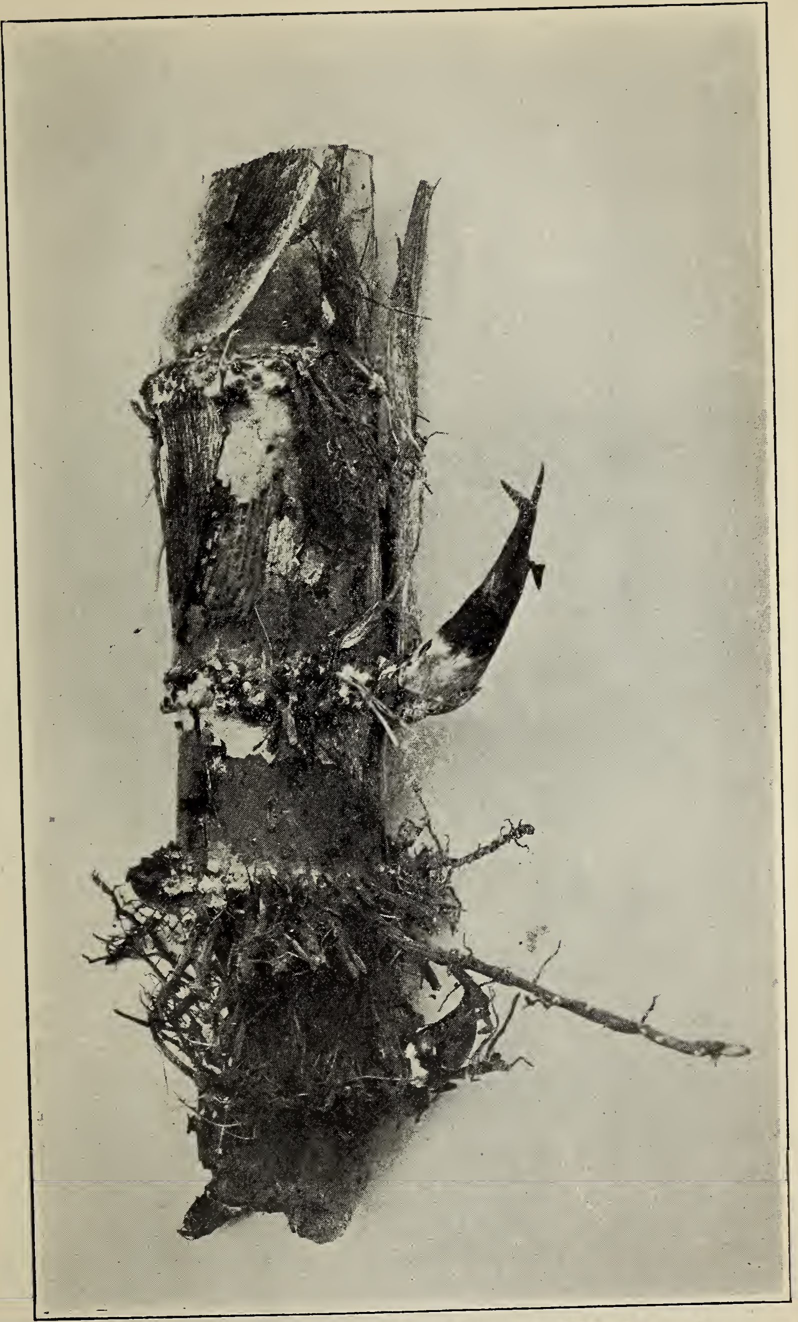

FIG. 4.—Stock of cane affected with root disease. The white mycelium is growing vigorously on the young shoots, and in the case of the long root extending to the right, white tufts of mycelium protrude from the breaks in the bark.

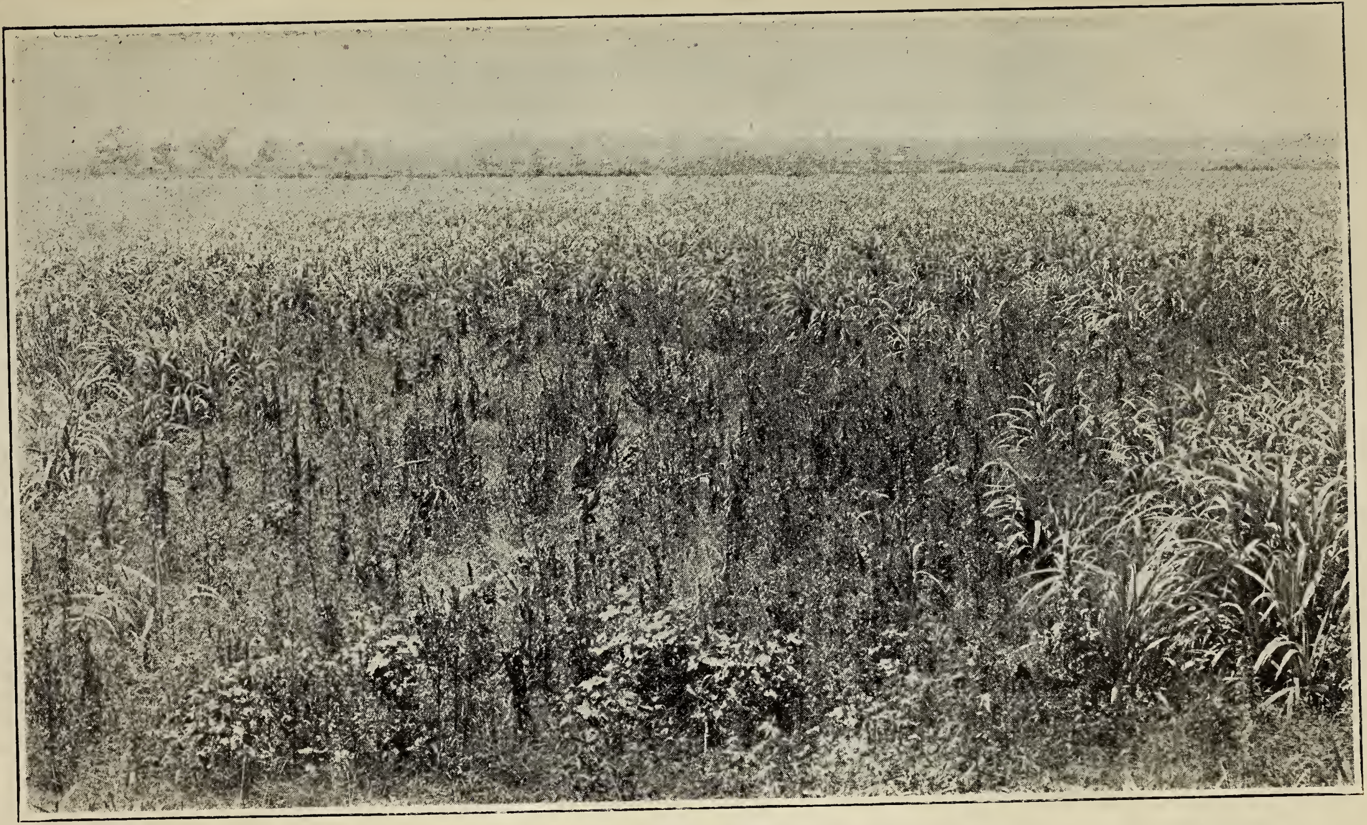

FIG. 5.—Portion of a field of stubble cane where the loss is very great. The few canes left in the affected area show the root fungus very prominently.

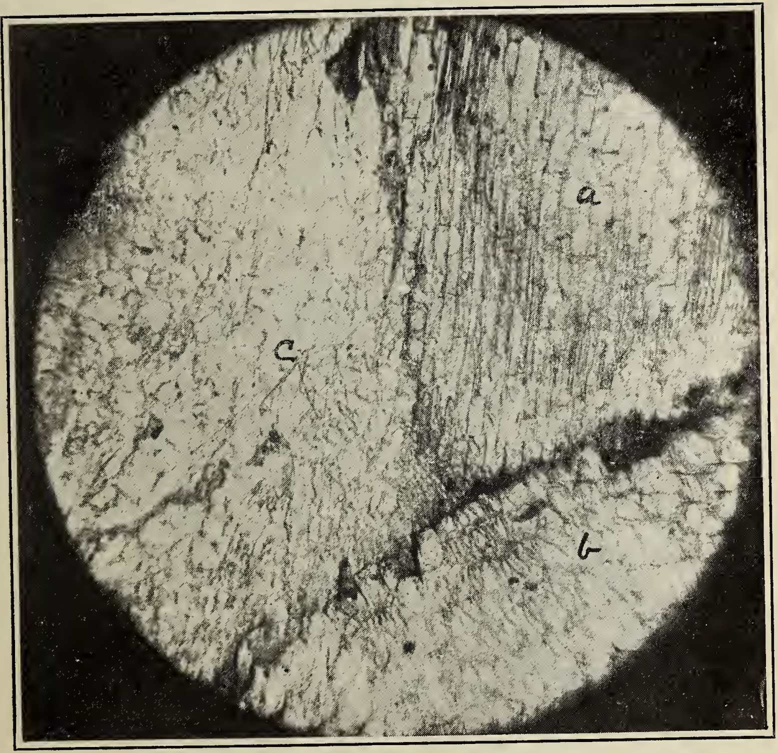

FIG. 6.—Microphotograph showing invasion of sugar cane root by the threads of the root disease fungus. *a* is a portion of the main root cut longitudinally; *b* is a root branch cut transversely; and *c* is a portion of disintegrated tissue from the mother stalk at the point of emergence, which is full of fungus threads. These are seen entering the cells of *a* and of *b*.

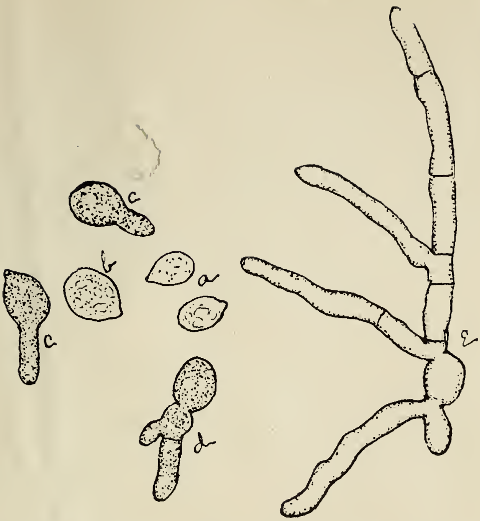

FIG. 7.—*a.* Spores of *Marasmius plicatus,* normal size. *b.* Spore swollen previous to germination. *c.* Spores in early stages of germination. *d* and *e.* Later stages of germination. x 1,000.

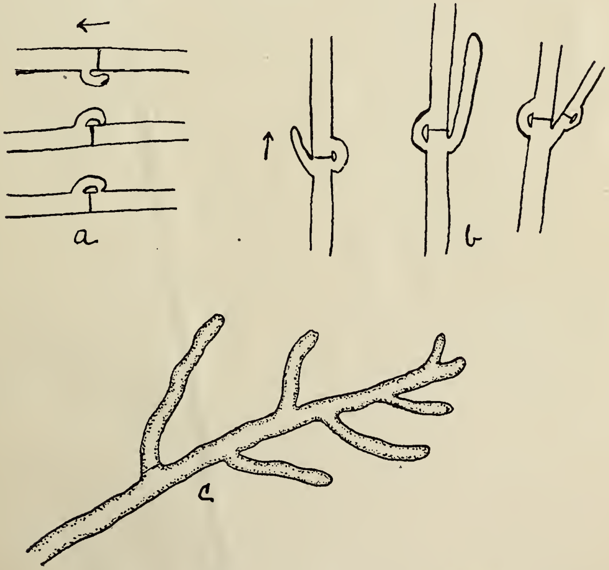

FIG. 8.—*a.* Mycelium of *Maramius plicatus,* showing stages in the formation of the clamp connections. *b.* Mycelium showing branches. *c.* An actively growing tip of the mycelium. x 1,000.

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